THE ARCHITECTURAL FORUM

IN TWO PARTS

PART ONE
ARCHITECTURAL DESIGN

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THE ARCHITECTURAL FORUM

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BOOK DEPARTMENT

SPANISH ARCHITECTURE IN SANTA BARBARA

A REVIEW BY

CLIFFORD WAYNE SPENCER

Of all the different styles of architecture which have been developed in various parts of the United States there is none more distinctive than that based on Spanish influence and found principally in the southern and far western states. The climate and scenic characteristics of these states being somewhat similar to those of southern Europe, it is no more than natural that the architectural ideas introduced by the early Spanish explorers should take firm root in the new soil and undergo a remarkable development. This development naturally has been somewhat different in the widely separated states, such as California and Florida, and each has produced a variation on the Spanish theme distinctly its own. In this respect California has been especially productive of much architectural progress, the so-called "Californian" architecture being quite distinctive and expressive of the conditions and surroundings under which it was developed. It has combined much of the harmony, restfulness and color of its inherited Latin culture with some of the best of that American architecture which in other parts of the country is dominated largely by English precedent.

A Patio in Santa Barbara
Bertram Grosvenor Goodhue, Architect

The rich, luxuriant, semi-tropical vegetation of central and southern California, coupled with the brilliance of the sunlight, makes a delightful setting for buildings whose walls are a sparkling white, relieved by touches of brilliant color and set off by roofs of brightly colored terra cotta tiles. Other characteristics of these houses are the lowness and the flatness of the roofs. Seldom is there a second story, and the roofs rarely ever have a pitch in excess of 30 degrees from the horizontal. This lowness and flatness give the effect of causing the buildings to seem to hug the ground and to nestle picturesquely among the brilliant foliage. The lowness of the structures naturally necessitates a greater area in the ground floor plan, which usually is exceedingly irregular and rambling in form, adding greatly to the charm and interest of the exterior as well as to that of the interior. This distinctive type of architecture may be said to have reached the pinnacle of its development at Santa Barbara, where a large number of the leaders of finance and fashion have made their homes, with the result that this city with its surrounding communities has one of the most notable collections of large country places and fine small houses in the United States. Here also the plant life reaches its maximum in luxuriance and variety. There is very little difference between the temperature of winter and summer, and the gardens are filled with a profusion of rare and beautiful flowering trees and shrubs imported from the far corners of the earth to add to the already large variety of native plants and trees. It is said that Santa Barbara has the largest range of ornamental trees and varieties of floral culture to be found outside of botanical gardens anywhere in the United States. This profusion of vegetation provides the right setting for the simple white walled houses so characteristic of the Californian style. As is natural in a community whose residents have come from all sections and climes, there are many discordant notes and badly conceived ideas, but, taken as a whole, the city presents less of the usual jumbled architectural confusion than most other American communities.

A collection of illustrations depicting a large number of the most worthy examples of the purely Californian architecture of Santa Barbara has been made and published by H. Philip Staats, with an introductory article by Charles W. Cheney. This introduction is in the form of an interestingly written historical and descriptive sketch of the town and its architecture, preparing the way for the illustrations that follow. These were made from photographs by a group of six professional photographers of Santa Barbara, and the pictorial quality and architectural interest of the scenes shown leave little to be desired. Illustrations of four different classes of buildings are presented,—historical buildings, such as the Santa Barbara Mission and several old adobe houses; municipal buildings; churches, clubs and theaters; commercial buildings; and residences. The Mission of Santa Barbara is one of the finest in the state, and has had a very marked influence on the development of the so-called "Mission" style in California. This, together with the *Casa de la Guerra* and the *Carillo Adobe*, is the outstanding example of the architecture which has come down from the Spanish explorers. They depend for their claim to beauty rather on their romantic charm and the mellow quality resulting from age than on any outstanding architectural worth. On the other hand, the Ludington and Heberton houses, the *El Paseo* group and the Lobero Theater, though of a considerably later

period, combine many of the qualities that go to make satisfying architecture. In the Lobero Theater, the dominant note is that of massiveness, while the interior with its odd shaped auditorium, is a welcome exception in a class of buildings whose treatments have been almost consistently bad. Among the most recent additions to the city's skyline is the new court house which is notable for its extravagant bits of design, although the whole is somewhat loosely put together. The group of commercial buildings includes such structures as a railroad roundhouse, a filling station, banks, offices and shops, as well as the magnificent Santa Barbara Biltmore Hotel, combining all the advantages of a great northern hotel with the quaint old world charm so characteristic of the surrounding residential neighborhood. These briefly described examples are but a few of the many interesting and beautiful buildings presented in plan and illustration in this volume. The general type of buildings found in this locality are too well known to the architectural profession to require much description, since a large majority of the examples shown have already been represented in the pages of the leading architectural journals, and those who have seen these isolated presentations will readily realize the value of a work of 125 plates devoted exclusively to the architecture of a town which has the distinction of being one of the few places where a majority of the inhabitants are "architecture" minded.

CALIFORNIAN ARCHITECTURE IN SANTA BARBARA. Edited by H. Philip Staats, with a Preface by Charles H. Cheney. 125 pp., 8 x 11 ins. Price $7.50 Net. Architectural Book Publishing Co., Inc., 108 West 46th Street, New York.

SKYSCRAPERS AND THE MEN WHO BUILD THEM. By Colonel W. A. Starrett. 347 pp., 6 x 9 ins. Price $3.50. Charles Scribner's Sons, 597 Fifth Avenue, New York.

THE building industry is fortunate in having Col. Starrett to write its saga. One of the most successful of a remarkable family of builders, he brings to his task an all-embracing knowledge of his subject in its many aspects, a graphic style, and above all, an enthusiasm for his chosen calling which goes far to explain his success; for, as Col. Starrett clearly shows, it is no place for the dilettante or the faint hearted.

Forty-five years ago William Le Baron Jenney commenced his designs for the Chicago office of the Home Insurance Company of New York. This was the first of all "skyscrapers." It was only ten stories high, but in it were incorporated the features which led to the towering structures of today. During the previous 25 years, there had occurred the development of the passenger elevator from an impractical novelty to a serviceable (if slightly hazardous) means of vertical transportation. Cast and wrought iron columns and beams had been built into brick and masonry to lighten dead loads and help reduce the massiveness of lower walls, and already the science of foundations was emerging from the traditions of the middle ages. Wherein, then, did the first skyscraper differ from its predecessors? "Jenney went a long and daring step further," Col. Starrett writes. "He actually carried out what no one ever had done in theory and practice before,—took the dead load off his walls and placed it on a skeleton framework of iron concealed inside the masonry." The upper part of this framework consisted of Bessemer steel beams,—among

the first to be rolled in this country. Many things were still to be done, and many discoveries to be made, before buildings of 30, 40 and 50 stories could be planned and erected, but that these things have come about in the span of a lifetime testifies to the courage, perseverance and ingenuity of the pioneers.

The capacity of the human mind to marvel is strangely limited. We exclaim at the apparent miracle of the radio one year, and complain the next of the quality of the reception or of the programs. In the same way, the replacement of a group of old buildings by an immense modern skyscraper in the space of a few months is so familiar a sight that the spectator may be forgiven for imagining it to be a matter of simple routine. He has seen the old buildings torn apart and removed,—he knows not where,—in trucks; he has watched with fascination the almost uncanny precision of the steam shovel as it scoops and nuzzles its way into the earth; he has heard the sharp staccato of the drills biting into rock; he has marveled at the skill and daring of the ironworkers as they build up the mighty skeleton tier by tier, and he has regarded with less lively interest the closing in of the building by the bricklayers. Of the foresight and planning that have made it possible for these operations to succeed one another without delay; of the engineering and structural problems that have been overcome; of the ways and means that have been devised to save time and money; of the ceaseless vigilance and the watchful attention over a myriad details,—of these the onlooker can have but a slight idea.

From Col. Starrett one learns all this, and more; the planning, designing, financing and estimating of the future structure; the taking of sub-bids and the letting of sub-contracts; the collection and distribution of information; the correlation of drawings, so that materials fabricated at a score of different points over the country will fit to a fraction of an inch when assembled at the building. He takes us through the steel mills, where the white-hot metal is rolled into a thousand shapes and sizes; through the fabricating shops, with the incessant clamor of riveting, where the structural shapes are built up into columns and girders, every one of which has been specially detailed and in which every rivet has been located weeks before. We are shown how a stone quarry operates and see the processes that ensue before the blocks of granite, limestone or marble are made to fit into their appointed places in the building. We learn the history of cement and the exacting requirements of its manufacture. And so on, through every phase of the construction of the building, we observe with him the romance of industry and the spirit of adventure which actuate the rank and file of a building organization. It is a continual fight,—waged against time, the elements, water, quicksand, and a thousand other difficulties which beset the builder at every stage. The parallel that Col. Starrett draws between the marshaling of the builders' forces and those of an army in the field, is well founded.

No book on building would be complete which did not consider the question of labor and the unions. Col. Starrett's criticism is constructive. The failure of the unions to attempt a solution of the intermittancy "which stalks as a spectre throughout the building trades mechanic's life" and reduces his yearly earnings to a little over a half-year's earning capacity; the absence of efficient machinery to deal with the problems of old age and sickness, and the economic,—and often senseless,—waste caused by the ever-recurring "jurisdictional" disputes, come under his fire. The benefits the unions have wrung from reluctant employers have been at the cost of hard fighting, and they are still hostilely arrayed in opposing camps. And yet Col. Starrett is not unsympathetic. His personal experience in the field has brought him into contact with the men as individuals, and he pays high tribute to their courage, their loyalty and resourcefulness in a crisis, and their ready generosity to one another when casualties occur,—as they do frequently.

As an economist, Col. Starrett takes a gloomy view of the present building situation, which he sums up succinctly in these words: "The building industry, disjointed, disorganized, with a clientele suspicious and largely uninformed of its complexity; with an architectural profession almost equally uninformed and clamoring for a recognition of superior knowledge of the problem which it never possessed and cannot maintain; with the banking and lending institutions throughout the country taking no stand for a stabilized industry, but relying on an assumed satisfaction with plans and specifications made in a medium they do not comprehend and written in a technical language that they cannot fully understand; with bonding companies as ready to insure the performance of an inexperienced beginner as an experienced builder, so long as the premium is paid; with importunate novices clamoring that they can build cheaper than any one else; with the sheriff waiting in the treasurer's office while frantic collections are being garnered in the banker's office to stave off for another brief period the hand of bankruptcy that overtakes 50 per cent of the kind in every five-year cycle;—is it not a wonder that absolute anarchy in the industry does not completely overwhelm it?" But, on the other hand, his exultation as a builder is contained in his own stirring words: "The thrill is always there, the unexpected is always happening; the satisfaction of planning in the welter of all this activity, and of having the plans come out right, of seeing the beautifully finished building come true and clean out of a complexity of elements that only a trained builder understands,—this is in itself an unparalleled triumph that gives a man the satisfaction of knowing that he is proficient in leadership."

The book, as Col. Starrett is careful to explain, is no attempt to present a technical treatise on building, but is intended primarily for the layman who desires to know something of the fundamentals that govern the science of modern construction, so that his understanding and appreciation, as a monster project takes form before his eyes, may be quickened. The book should do this, and more; it should give to the prospective owner a clearer understanding of the problems which confront him and of the pitfalls into which inexperience might lead him. To the architect, the frank exposition of the builder's viewpoint should bring a more intelligent perception of their mutual relationship to the problem in hand,—a relationship which, too often, is distinguished by antagonism and distrust.

The apprenticeship problem receives careful consideration. The European system of long periods of training for a thorough understanding of all phases of a craft has given way to the modern trend of specialization, and the "all-round" mechanic is a thing of the past. Instead

we have carpenters specializing in the erection of concrete forms, others in the hanging of doors, others in the laying of floors, others in the installation of "trim," and so on. It is only in recent years that concerted action has been taken to raise the standards of workmanship and insure an adequate supply of newcomers to replace those incapacitated by years or injuries. This has been due to the efforts of the late Burt L. Fenner, of the firm of McKim, Mead & White, who devoted a great deal of his time to this important question and sponsored the plan leading to the formation of the Apprenticeship Commission by the New York Building Congress, whose scope is ever widening. The plan, in outline, consists of the training over a period of from three to four years of a certain number of boys as agreed upon between a committee of employers and representatives of the union. The curriculum is divided between work at the trade during the day and class work, usually conducted at night. The wages and scope of the training are determined by the committee, and a careful record is kept of the attendance and progress.

BUSINESS LAW FOR ENGINEERS. By C. Frank Allen. Third Edition. 475 pp., 6 x 9 ins. Price $4. McGraw-Hill Book Company, 370 Seventh Avenue, New York.

ARCHITECTS and engineers have much need of a working knowledge of law, particularly in its application to contracting and building. In these days when the activities of both professions seem to be undergoing radical change or rather to be extending their spheres of action, an architect (and presumably an engineer) is often compelled, even against his wishes, to become more or less of a promoter to bring new capital into an enterprise or else to further the development of some sort of a project; and most architects and many engineers know that they are at times called upon to act as arbitrators, referees or umpires between contractors.

This volume represents the third edition of a work already well known to those for whom it was written. Its author is a member of the Massachusetts Bar, of the American Society of Civil Engineers, and was formerly a professor at the Massachusetts Institute of Technology. "The purpose of this book is not to make 'every man his own lawyer,' but rather to give the engineer a sufficient understanding of important fundamental features of law, so that he may have some idea of when or how to act himself and when to seek expert advice, as well as to enlarge his horizon and perhaps encourage him to further study of law. Many engineers will find that there is some chapter which covers ground concerning which they are better informed than the author or even than most practicing lawyers. They will, nevertheless, probably find other chapters with which they are less familiar, and which may prove interesting." The work is divided into two parts, the first entitled "Elements of Law for Engineers," dealing with such subjects as Evidence, Contracts, Equity, Real Property, Agency, Sales, and Negotiable Instruments, while the second discusses Information for Bidders, Proposals, Uniform Contract Forms, Cost Plus Contracts, Bonds, and Specifications. The usefulness which has brought two editions into service should guarantee the favorable reception of a third by architects and engineers.

Unless otherwise noted, books reviewed or advertised in THE FORUM will be supplied at published prices. A remittance must accompany each order. Books so ordered are not returnable.

THE EDITOR'S FORUM

CONTEMPORA EXPOSITION OF ART AND INDUSTRY

IT is now several months since record crowds attended the first Exhibition of Contemporary American Industrial Art at the Metropolitan Museum. The single large gallery in which this exhibition was arranged was totally inadequate to accommodate the enormous number of people who visited the exhibition every day. If any were in doubt as to the growing popularity of and the increasing interest in contemporary furniture and interior decoration, the great number of visitors should have convinced them. The spring exhibition of the American Designers' Gallery also elicited great interest on the part of the general public, and now within a period of six months a third exhibition of modern art in industry has been arranged by Contempora, Inc., in the galleries of the Art Center in New York. Of particular interest in the exhibition, arranged by members of this firm, all of whom are designers of international prestige, are the ensemble rooms which may be bought complete. Each room will be available in any one of six color combinations to suit the individual taste of the purchaser. The rooms are to be sold as units, thus obviating the arduous task of shopping for harmonious accessories. It is planned to create about 12 types of rooms, which will be commercially procurable at moderate prices. This exposition comprises seven harmonized rooms by Bruno Paul, Lucian Bernhard, Paul Poiret and Rockwell Kent, as well as textiles, lighting fixtures, ceramics, and an exhibition of architectural designs by Eric Mendelsohn.

COLUMBUS MEMORIAL LIGHTHOUSE ARCHITECTURAL COMPETITION

ANNOUNCEMENT was made lately by the Pan American Union of the names of the authors of the ten designs which were placed first in the architectural competition for the Columbus Memorial Lighthouse. The names of the winners are:

Rice Amon, New York.
Helme, Corbett & Harrison, and W. K. Oltar-Jevsky and Rogers & Poor.
Douglas D. Ellington, Asheville, N. C.
Joaquin Vaguero Palacios, Madrid.
Josef Wentzler, Dortmund, Germany.
Filippo Medori, Rome.
Louis Berthin, Paris.
Theo Lescher, Paris.
Donald Nelson, Paris.
J. L. Gleave, Nottingham, England.

The selections were made by an international jury, selected by the competing architects, who met at Madrid and consisted of Raymond Hood for North America, Eliel Saarinen for Europe, and Horacio Acosta y Lara for South America. The authors of the ten designs placed first by the international jury will now recompete in the second stage of the competition for the final selection of the design for the Lighthouse. Mr. Acosta y Lara, the South American member of the jury, is the president of the Uruguayan Society of Architects, Professor of Architecture at the University of Montevideo, and a member of the Central University Council. Mr. Hood, of New York, is a member of the American Institute of Architects and the Architectural League of New York. He was associated with John Mead Howells in designing and erecting the *Tribune* Tower Building, in Chicago, and he also designed and built the American Radiator Building in New York. Mr. Saarinen is a native of Finland and one of the leading architects of Europe, having specialized in city planning and municipal enterprises. Mr. Saarinen has served on several international juries, including the architectural competition at the Olympiad in 1924; on the competition for a Parliament House at Canberra, Australia; and as a member of the City Planning Competition at Bergen, Norway. He is Vice-president of the International City Planning Conferences and a member of many architectural associations.

The members of the jury were selected by the more than 1,900 architects in all the nations of the world who registered for the competition which is being conducted by the Pan American Union according to the terms of a resolution adopted at the Fifth Pan American Conference. The Lighthouse will be erected on the coast of the Dominican Republic, the scene of the first permanent settlement in America, and will commemorate in an appropriate manner the discovery of the New World by Columbus.

THE GEORGE G. BOOTH TRAVELING FELLOWSHIP

THE George G. Booth Traveling Fellowship in Architecture at the University of Michigan has been awarded to Frederick J. B. Sevald (1929), of Detroit. The second place was awarded to Jonathan A. Taylor (1929), of Ann Arbor; honorable mention to Livingstone H. Elder (1928), Billings, Mont. There were 12 competitors. The problem this year was "A Municipal Boat House," involving, in addition to facilities for boats, a ball room, lounge, refreshment and service rooms, a roof garden and lookout. Only 11 days were allowed for the competition, the students preparing drawings without criticism.

A CLEMCO DESK

Officers' Quarters of the First Trust & Savings Bank, Chicago. Showing the "CLEMCO" Berkshire Suite as Installed by Marshall Field & Company, Chicago. Architects: Graham, Anderson, Probst and White. General Contractors: Leonard Construction Company.

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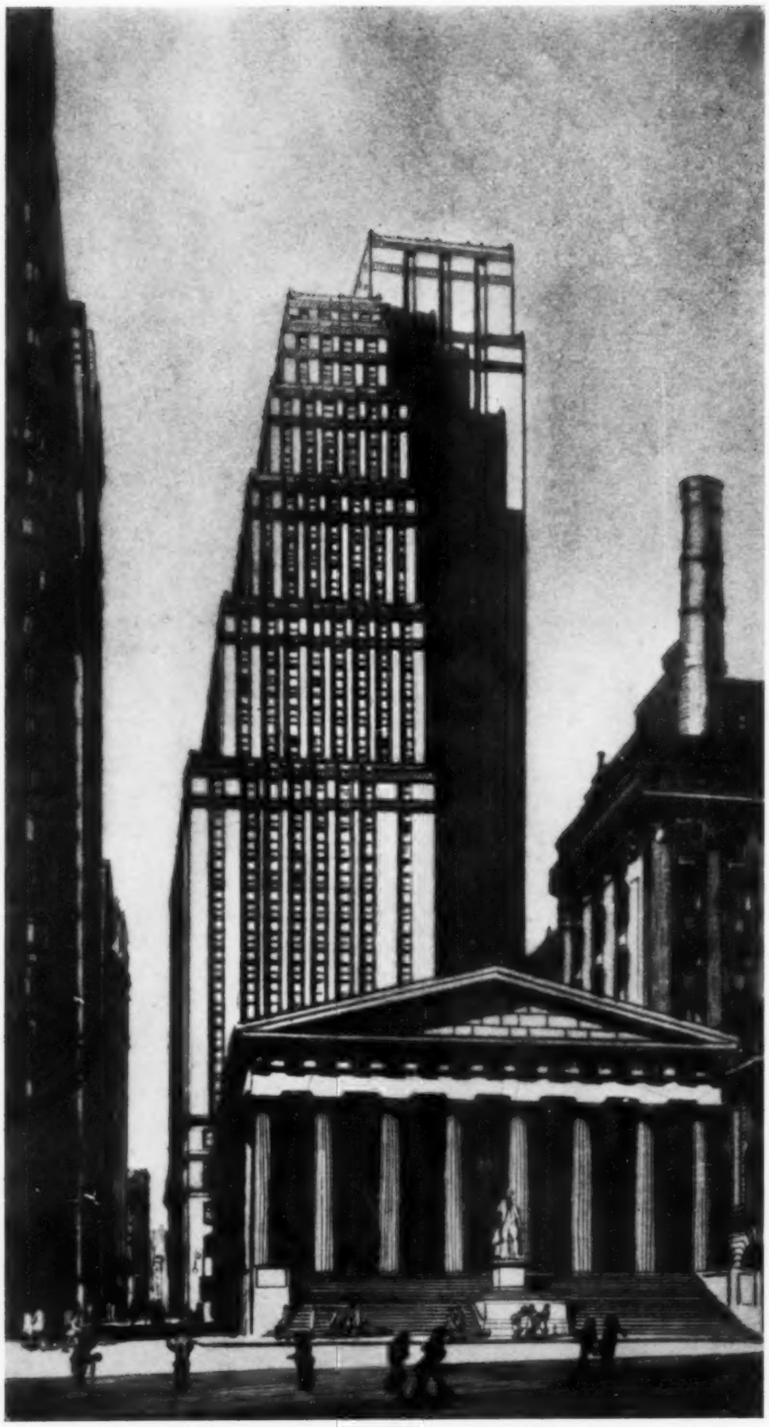


CHASE NATIONAL BANK BUILDING, NEW YORK
GRAHAM, ANDERSON, PROBST & WHITE, ARCHITECTS
From an Etching by Peter Marcus

THE
ARCHITECTURAL
FORUM

VOLUME LI NUMBER ONE

JULY 1929

THE CHASE NATIONAL BANK BUILDING, NEW YORK

BY

ALFRED SHAW

THE Chase National Bank Building, recently completed in New York, fulfills every essential requirement of the modern American commercial problem. It was erected at the foot of Manhattan Island, which has produced the amazing pile of steel and stone that symbolizes America to most Europeans. It was restricted by the new zoning laws of New York; planned on an irregular L-shaped piece of property, in which there was but one square corner, every square inch of which was needed for use by the owner. It was studied as to its economic possibilities during the period of real estate negotiations; and it was erected under the terrific pressure of mounting interest rates and demands for space and use. The engineering difficulties involved the problem of excavating to bed rock on the very toes of ponderous buildings, and of building foundations and basement floors while the bracing necessary to hold adjacent walls was still in place. It was also necessary to make every part of the building easily accessible by elevators, well warmed in winter, well ventilated in summer, and well lighted both by daylight and by electricity. The telephone exchange, large enough to make it possible for any person at any point in the building to talk with any part of the United States and some parts of Europe, is as large as the exchange in Hartford.

The venerable tradition and the present dignity of the Chase National Bank demanded an exterior design of fine architectural character. The officers of the bank as well as the architects realized the significance of creating a building which would not only be expressive of this dignity, but also individual and highly indicative of the new American architecture. As the studies progressed, the pyramidal mass suggested some of the characteristics of the architecture of Egypt, and in this direction the architectural scheme developed. Both the exterior and the interior have been designed with a feeling for the simplicity of Egyptian detail, and the color which is used in the more important rooms was selected from the same source. The five and one half stories below the street level contain the safe deposit department, the currency departments, and the great vaults which run through three stories, resting on the rock 85 feet below the street. On the first floor are the main banking room and the loan and discount department, which extend through two stories. On the third floor is the credit department, and on the fourth floor are the offices of the chairman of the board, the president, and the chief executives, as well as an extremely interesting board room which is in the form of half an ellipse.

The trust department occupies the fifth and sixth floors, the Chase Securities Corporation the eighth and ninth floors, and the working forces of the bank occupy space extending through seven stories to the 13th floor, from which point up the building is occupied by offices of a general commercial nature. At the very top of the building, on the floors which give magnificent glimpses across and over Manhattan and its rivers and environs, are the club rooms and dining rooms of the executive and junior officers of the bank. The building was first considered in November, 1926, and the property was purchased then; drawings were made; engineering difficulties and architectural problems were solved; plans for workings of the bank down to its most humble employe were completed; contracts were let, furnishings purchased, and the bank was occupied on August 28, 1928. This was due to the realization of all concerned of the extent of the task before them and the whole hearted coöperation of the officers of the bank, the chairman of the building committee, and the entire organization, with the architects and the engineers. Great enterprises of this sort require the thought, enthusiasm and determined courage of many people. Into this structure have been built the ardor and spirit of all of them.

Photo, Sigurd Fischer

MAIN ENTRANCE ON PINE STREET
CHASE NATIONAL BANK BUILDING, NEW YORK
GRAHAM, ANDERSON, PROBST & WHITE, ARCHITECTS

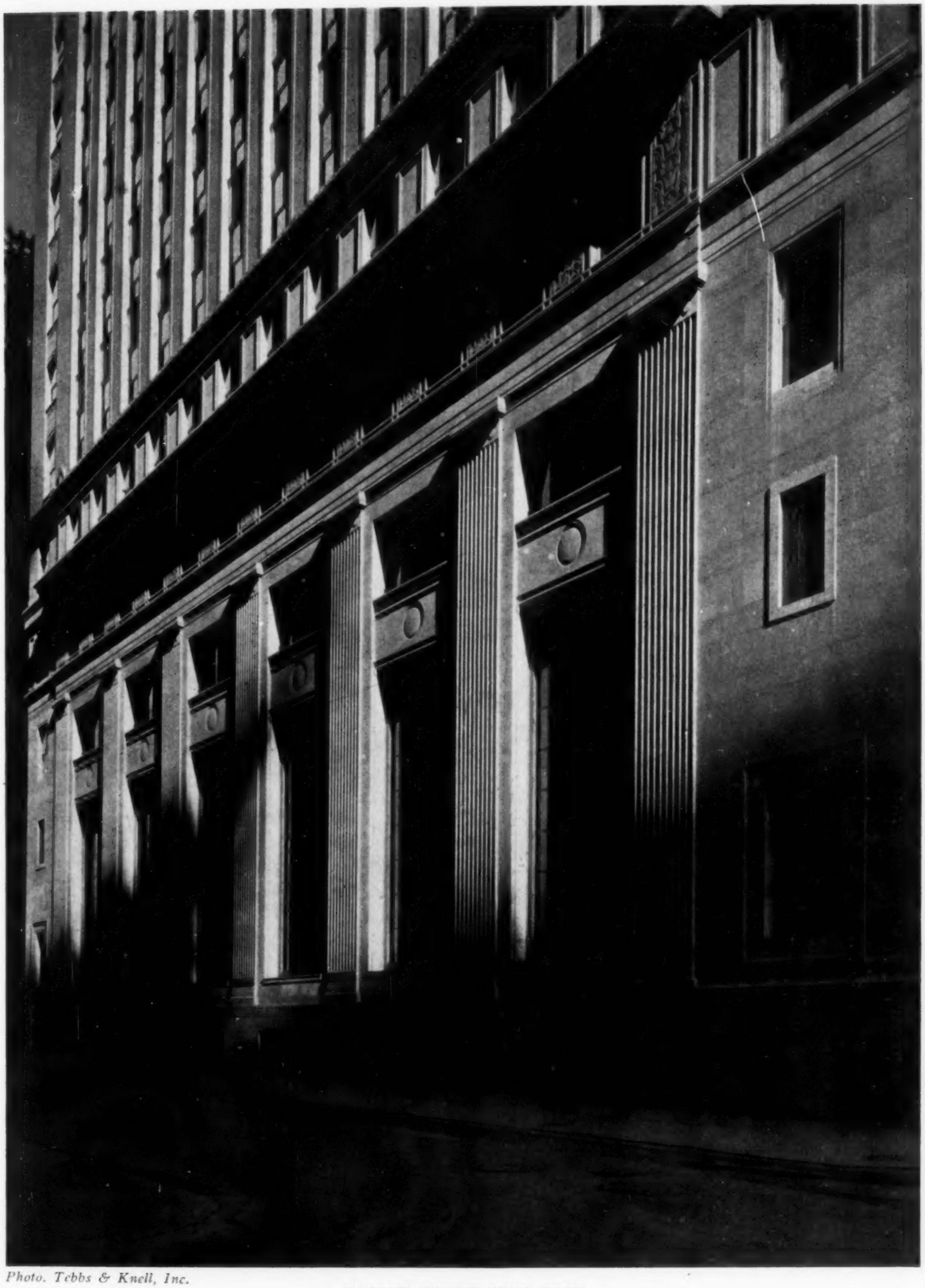


Photo. Tebbs & Knell, Inc.

NASSAU STREET ELEVATION
CHASE NATIONAL BANK BUILDING, NEW YORK
GRAHAM, ANDERSON, PROBST & WHITE, ARCHITECTS

Photo. Sigurd Fischer

AN ELEVATOR DOOR
CHASE NATIONAL BANK BUILDING, NEW YORK
GRAHAM, ANDERSON, PROBST & WHITE, ARCHITECTS

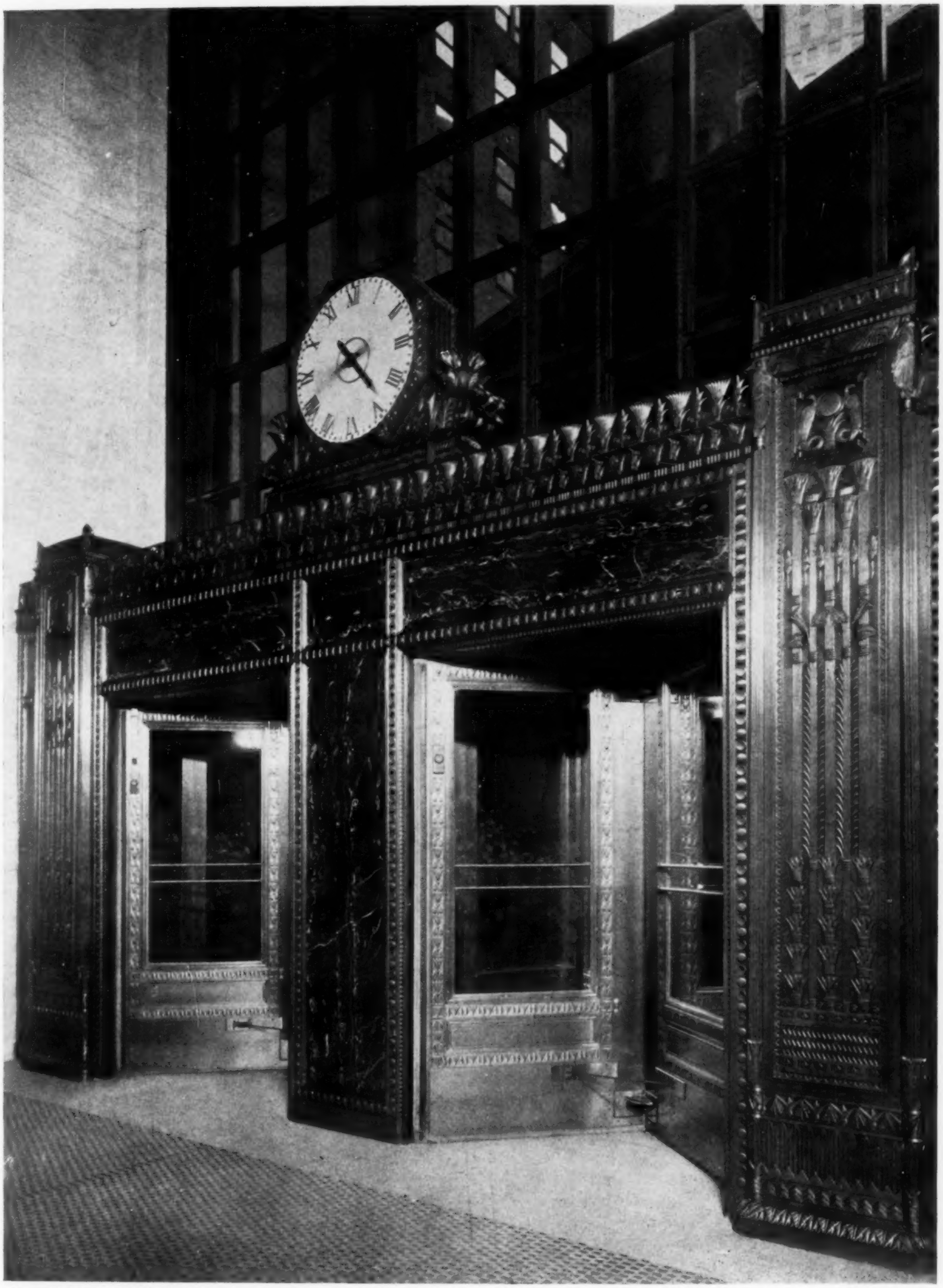


Photo. Tebbs & Knell, Inc.

INTERIOR OF ENTRANCE DOORS
CHASE NATIONAL BANK BUILDING, NEW YORK
GRAHAM, ANDERSON, PROBST & WHITE, ARCHITECTS

A Dining Room. Chase National Bank Building, New York
Graham, Anderson, Probst & White, Architects

AN APPRECIATION

BY

MATLACK PRICE

FOR all that the attention of New York's island citizens is momentarily focused on the intensive building of great towers in the midtown region, towers of finance and commerce continue to rise shoulder to shoulder in the downtown section. About these acres of the island's lower end a great volume should be written, which might be an architectural book or might be an epic poem in blank verse. "Laid out by Euclid, built by Titans, furnished by Edison" someone wrote 25 years ago. Much has happened since, among other things the set-back requirement in designing tall buildings, first seen as a restriction, but now as an opportunity, and as the point of departure of an entirely new vision of architecture.

One of the newest additions to the now almost solid phalanx of great buildings in lower New York is the Chase National Bank, rising 38 stories to a height of 478 feet behind the old Sub-treasury Building,—classic relic of another age. This is an old Doric temple, symbol of everything that once epitomized architecture. It is still a symbol, but architecture has mounted skyward since the Sub-treasury was built, and has become at once more complex and more simple,—more complex in its aims, requirements and accomplishments; more simple in its means of providing modern, efficient, urbane housing for vast and intricately ramified organizations such as the Chase National Bank, which is one of this country's greatest banking organizations. The site of the new Chase National Bank Building was not, architecturally, easy to deal with, but it would have presented a much more difficult problem to the architect of 20 years ago than it presented to the architect of today. There is frontage on Nassau and Pine Streets, with a narrow L giving a frontage and entrance on Cedar Street, and only one square corner in the whole plan. In the architecture of yesterday, an architecture having to do mainly with facades, this would have been a desperately unhandy site. Under the terms of our architecture of today, which has to do mainly with masses, the matter finds a more natural solution. A building now can be piled up with all the rugged informality of a natural rock formation. Its diminishing masses may be set at angles oblique with the substructure,—which would have

played havoc with a formal or conventional facade.

With the essential masses of his building determined, the modern architect has now only to concern himself with a manner of treatment, and this, it has been found, is best when it is simplest, and when it abandons, largely, the old "stock" architectural embellishments that have, after years of faithful service, earned a rest in quiet retirement. As was said in these pages last month about the Chanin Building, architects have wisely come to the conclusion that the copings of the great massive shoulders of the new buildings are not good places to set little urns and obelisks. So strong was the habit of using detail for detail's sake that it was first believed that set-backs needed some kind of extraneous embellishment in order not to look bleak or "unfinished." Fortunately, the immutable laws of scale asserted themselves, and demonstrated that no embellishment of set-backs can be trivial or unrelated, and that if any detailed treatment of the great masses is to be attempted, it must be of such heroic mould as that on the New York Telephone Building, the Shelton Hotel or the Chanin tower. Thus, on the corners of the parapet of the first set-back on the Chase National Bank Building, there is a great winged sphinx head, with the wings modeled into the coping, and in lesser set-backs above this these are repeated, an interesting motif, and one in conformity with the Egyptian detail used elsewhere.

The main entrance is on Pine Street, a monumental portal to the bank proper and a less architectural entrance for the office tenants. The whole design of the main entrance is unusually interesting,—an elaborate Egyptian design in finely wrought bronze set in a frame of pink Tennessee marble carved with close adaptations of 22 historical coins and an American dollar. These have afforded a decorative motif that is more than symbolical; it is a highly appropriate decoration for a bank entrance, and a reminder that the bank houses the Chase Bank Collection of the Moneys of the World, the famous collection started in 1882 by Farran Zerbe, who is now its curator. The collection is believed to include the greatest number of varieties of exchange media ever collectively displayed, and from this wealth of material many coins were chosen as bas-relief decorations for the enframement of the bank's entrance. Beginning at bottom, left: Roman *sestertius*, *stater* of Metapontum, early Greek coin of Poseidonia, Spartan coin of Tarentum, the Hebrew *shekel*, the *aureus* of Augustus, sixteenth century Dutch coin, *testone* of the Italian Renaissance, colonial Pine Tree shilling, *testone* of Francis I, Spanish milled dollar, the American Peace Dollar, the Joachimthaler, Elizabethan gold pound, New York cent, Japanese *yen*, Russian two-*kopeck* piece, the *florin*, Ptolemaic coin, early Greek *tetradrachm* of Alexander the Great, *stater* of Corinth, *decadrachm* of Syracuse. The coins represented were selected with the help of the American Numismatic Society, and from plaster casts the enlargements for the marble cutter were made by the sculptor, M. H. Kock, who also modeled most of the Egyptian detail.

This portal of historic coins opens to a landing from which a few steps lead up to the mezzanine floor and down to the banking space, where the tellers are found. The great mezzanine office floor consists mainly of one large room, with private offices in alcoves. The walls, unelaborated, are of Roman travertine, and the ceiling is of dull gold and polychrome, in Egyptian motifs. The whole effect is that of quiet restfulness and dignity,—a perfect environment for the transaction of important business. The bank occupies 13 floors of the building, with a reservation covering five more, and in basements and sub-basements there are vaults as far down as five stories below grade. From the banking space and mezzanine, elevators serve the bank exclusively, while other elevators, local and express, are found in the public lobby that serves the building as a whole.

Architecturally, the most interesting of the bank's floors above the main floor is the fourth, where are located the reception room, directors' room, law library, and offices of the senior executives. The whole atmosphere here is that of dignified repose,—walnut paneling, carpeted floors, the feeling of a distinguished club as opposed to a commercial office environment. Portraits of the principal officers are framed architecturally in simple mouldings that match the woodwork, instead of in heavy gold. A generation ago these interiors would have been pompous and ornate, heavy with grandiose impressiveness; here they are gracious, quietly well bred, admirably expressive of the essential spirit of the organization. The directors' room is patterned very closely after the room of the Supreme Court in Washington. A Georgian ceiling, fan-ribbed in the Adam manner, pilasters of a specially sought green marble, and a great semi-circular table, following the semi-circular shape of the room, with the chairman's seat at the center of the straight wall. A room that is serious without being solemn and suggesting efficiency without ignoring graciousness.

Far above this floor,—on the 33rd and 34th floors,—are dining rooms, with a fully equipped kitchen on the 35th. On the 34th floor are officers' dining rooms, several private dining rooms and a lounge, with furniture not too particularly stylized,—American Chippendale, perhaps, commendably simple, and old with even more of the atmosphere of the most distinguished sort of club than the fourth floor. On the 33rd floor are other

Corner Detail. Chase National Bank Building, New York
Graham, Anderson, Probst & White, Architects

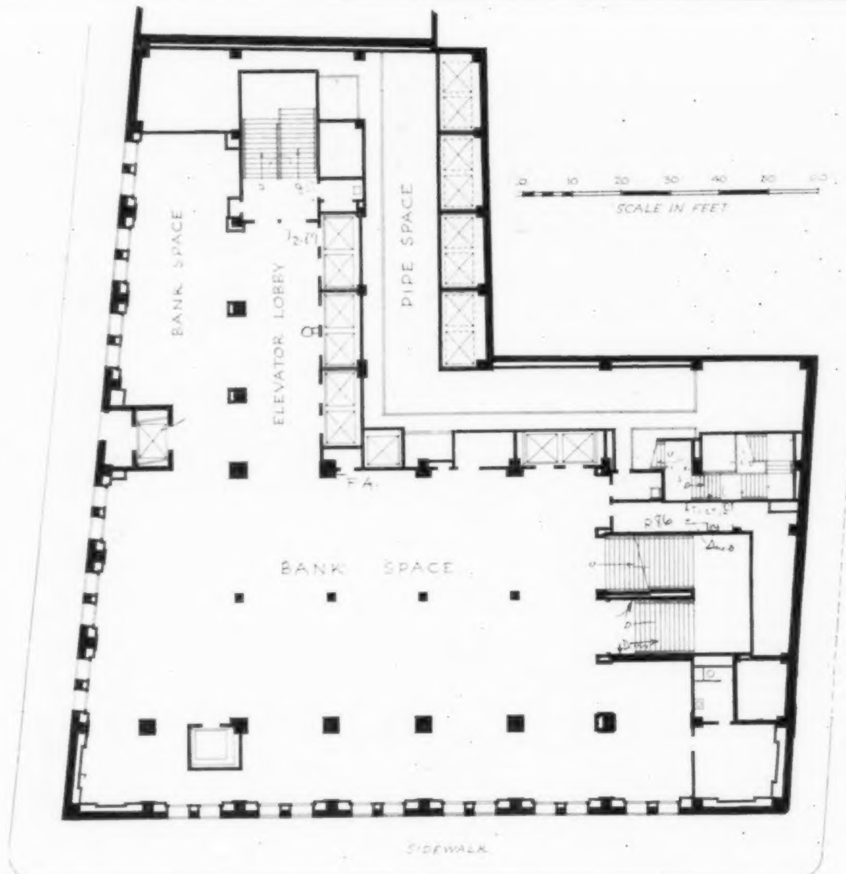
officers' dining rooms, the larger room pleasantly chintz-curtained, and here, too, is a private dining room in oak, and another entirely papered with old maps, antiquely mellowed with shellac.

In this kind of a building there are architectural qualities more or less pictorial,—incidents, details, interiors that lend themselves to description, and there are other qualities, no less architectural and far more important, that cannot well be visualized. Here is an organization of 3,000 people in this one building, engaged in work so important and exacting that much of it must be pursued on a 24-hour daily basis. When a bank clears daily checks aggregating at times $250,000,000, efficiency needs to be more than the mere catchword of some office martinet. It must be a very real thing, and in the planning of this structure the architects worked in close coöperation with certain of the bank's officials, three vice-presidents—Messrs. Reeve Schley, James T. Lee, and William H. Moorhead. With the architects these men planned those essentials of the practical relationships of the different working departments, not only as of today, but with a view to inevitable future growth. There could be no lost motion in the contacts of one department with another, in the location of files and records. The problem departed from architecture, academically considered, and demanded that architecture make an intensive and practical study of bank management in all its varied phases and requirements. Both architects and bankers needed one another's most intelligent and expert coöperation, and to this partnership the Chase National Bank Building stands as a significant monument. The architects and bankers must feel a joint as well as an individual pride of achievement,—a sense that together they have created an intricately articulated whole,—a modern building designed for a modern bank. The structure as it stands adds a new note to New York's financial district, and striking as showing the change to the new from the old is the structure of the Chase Building beyond the Doric porticoes of the old Sub-treasury.

Photos. Sigurd Fischer

Plans on Back

CHASE NATIONAL BANK BUILDING, NEW YORK
GRAHAM, ANDERSON, PROBST & WHITE, ARCHITECTS

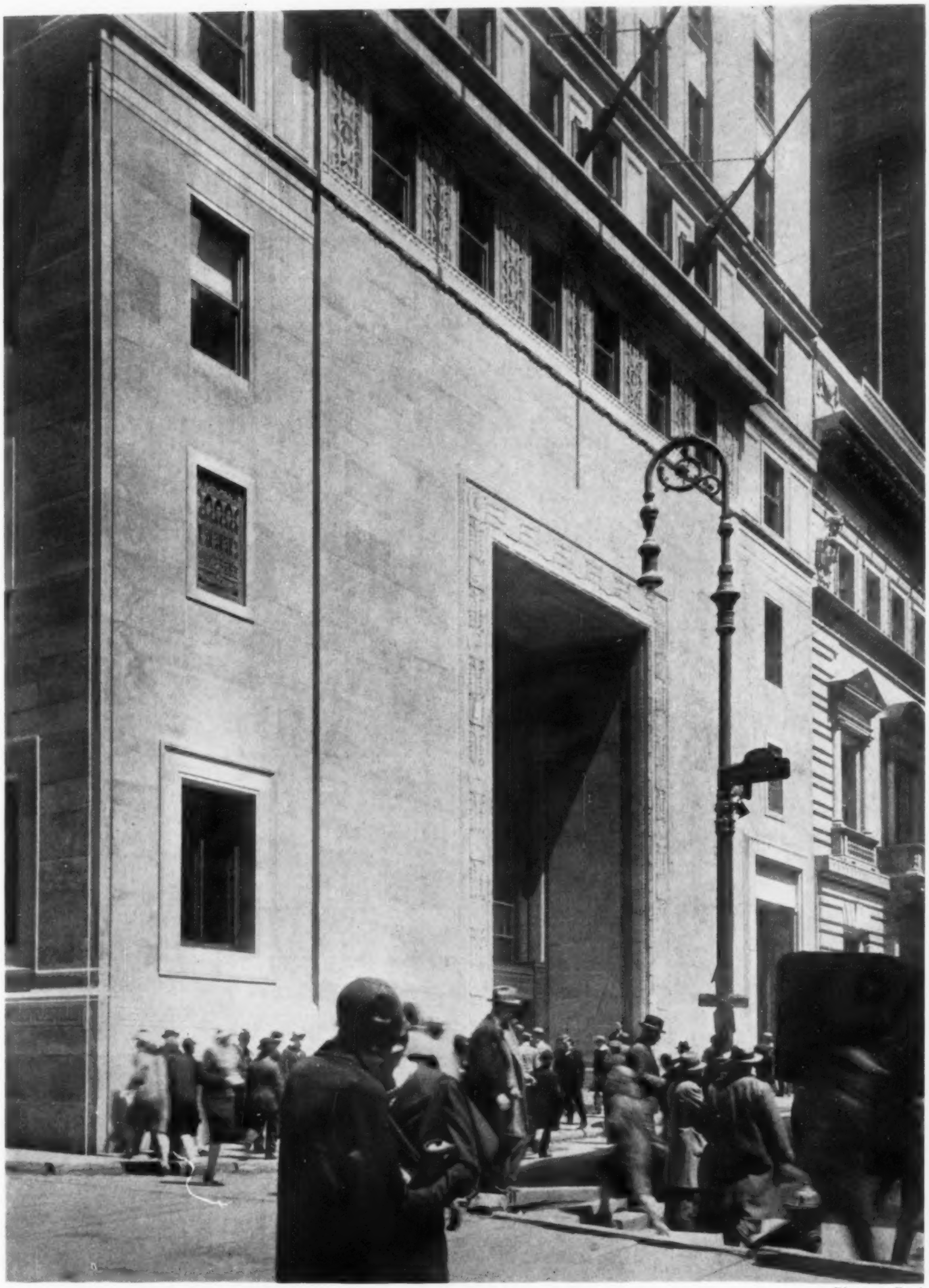


GROUND FLOOR

BASEMENT "A"

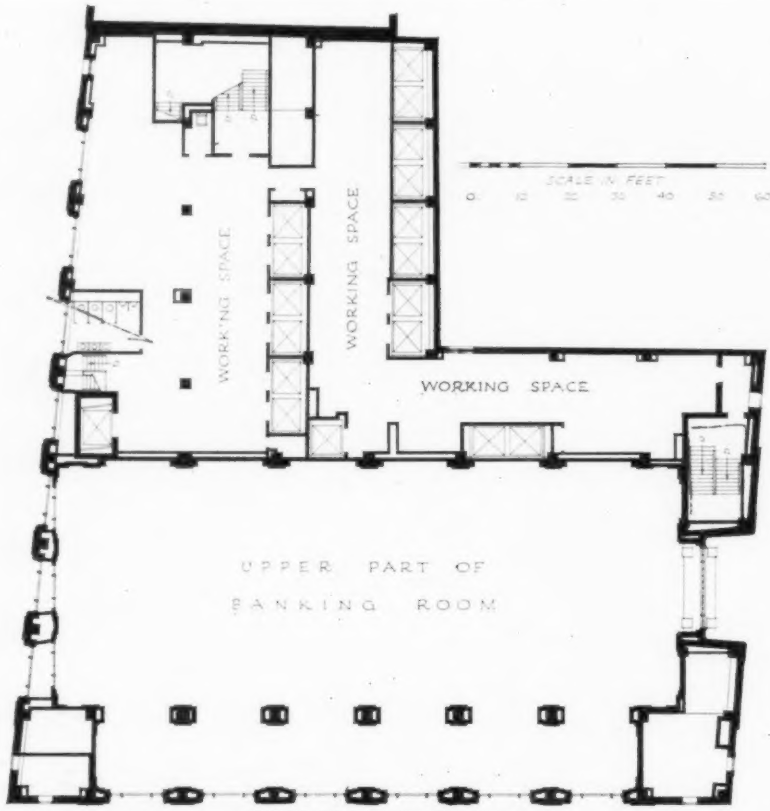
PLANS. CHASE NATIONAL BANK BUILDING, NEW YORK

GRAHAM, ANDERSON, PROBST & WHITE, ARCHITECTS

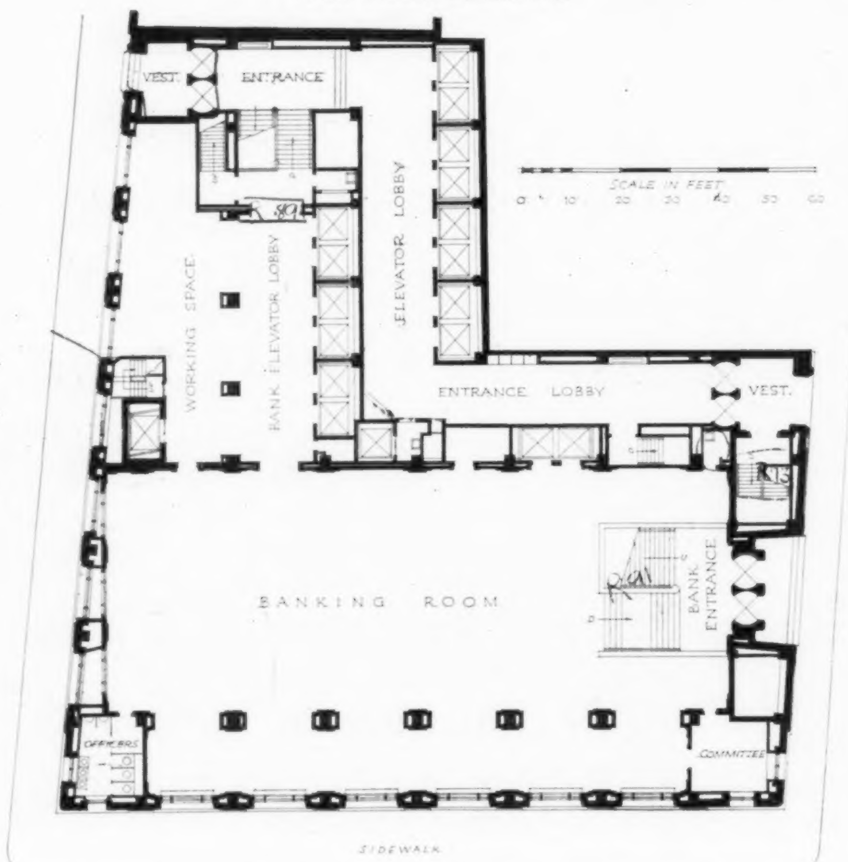


Plans on Back

ENTRANCE ON PINE STREET
CHASE NATIONAL BANK BUILDING, NEW YORK
GRAHAM, ANDERSON, PROBST & WHITE, ARCHITECTS



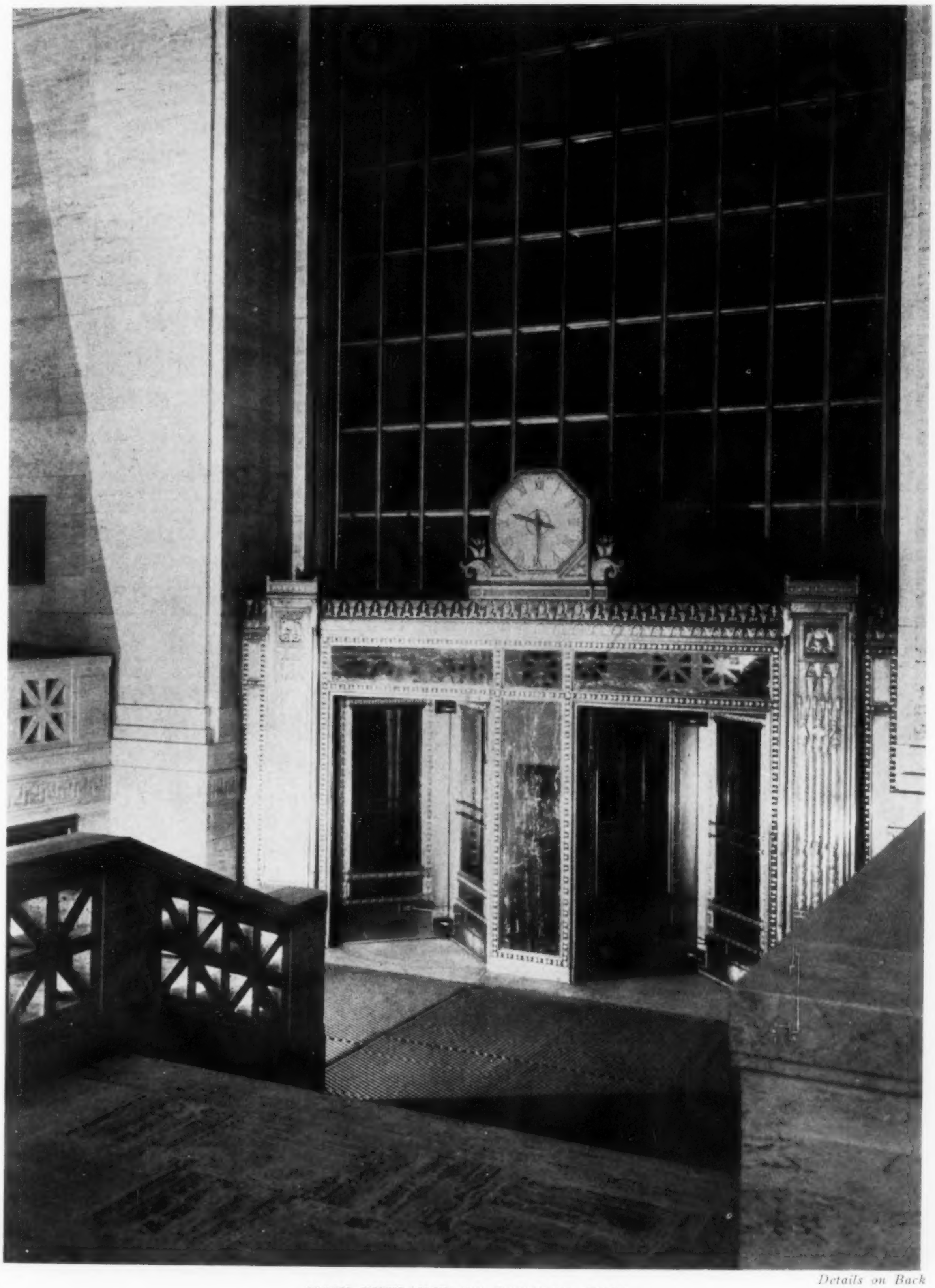
FIRST FLOOR MEZZANINE



FIRST FLOOR

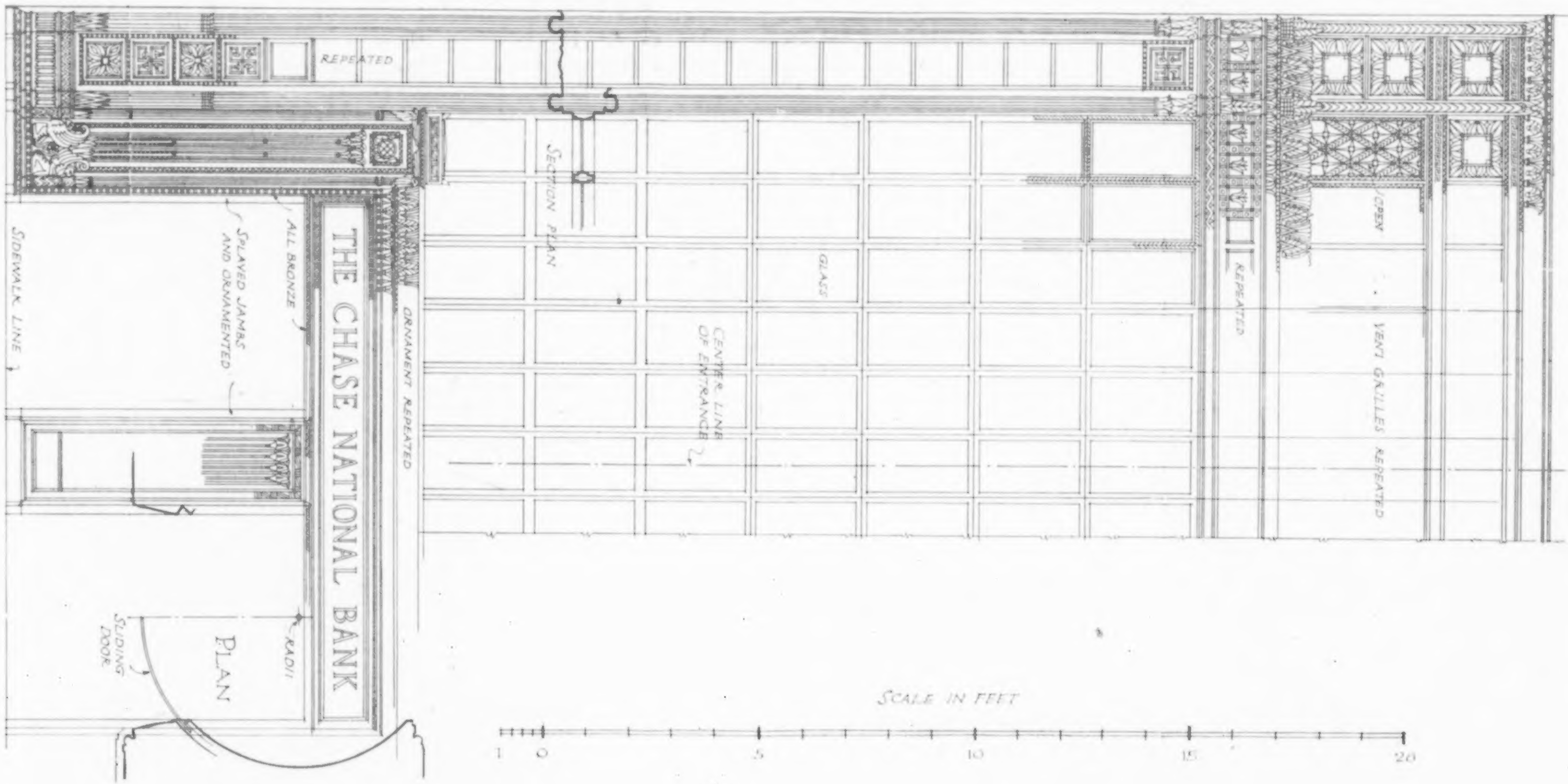
PLANS: CHASE NATIONAL BANK BUILDING, NEW YORK

GRAHAM, ANDERSON, PROBST & WHITE, ARCHITECTS



Details on Back

MAIN ENTRANCE TO BANKING ROOM
CHASE NATIONAL BANK BUILDING, NEW YORK
GRAHAM, ANDERSON, PROBST & WHITE, ARCHITECTS



ENTRANCE DETAIL

CHASE NATIONAL BANK

NEW YORK CITY

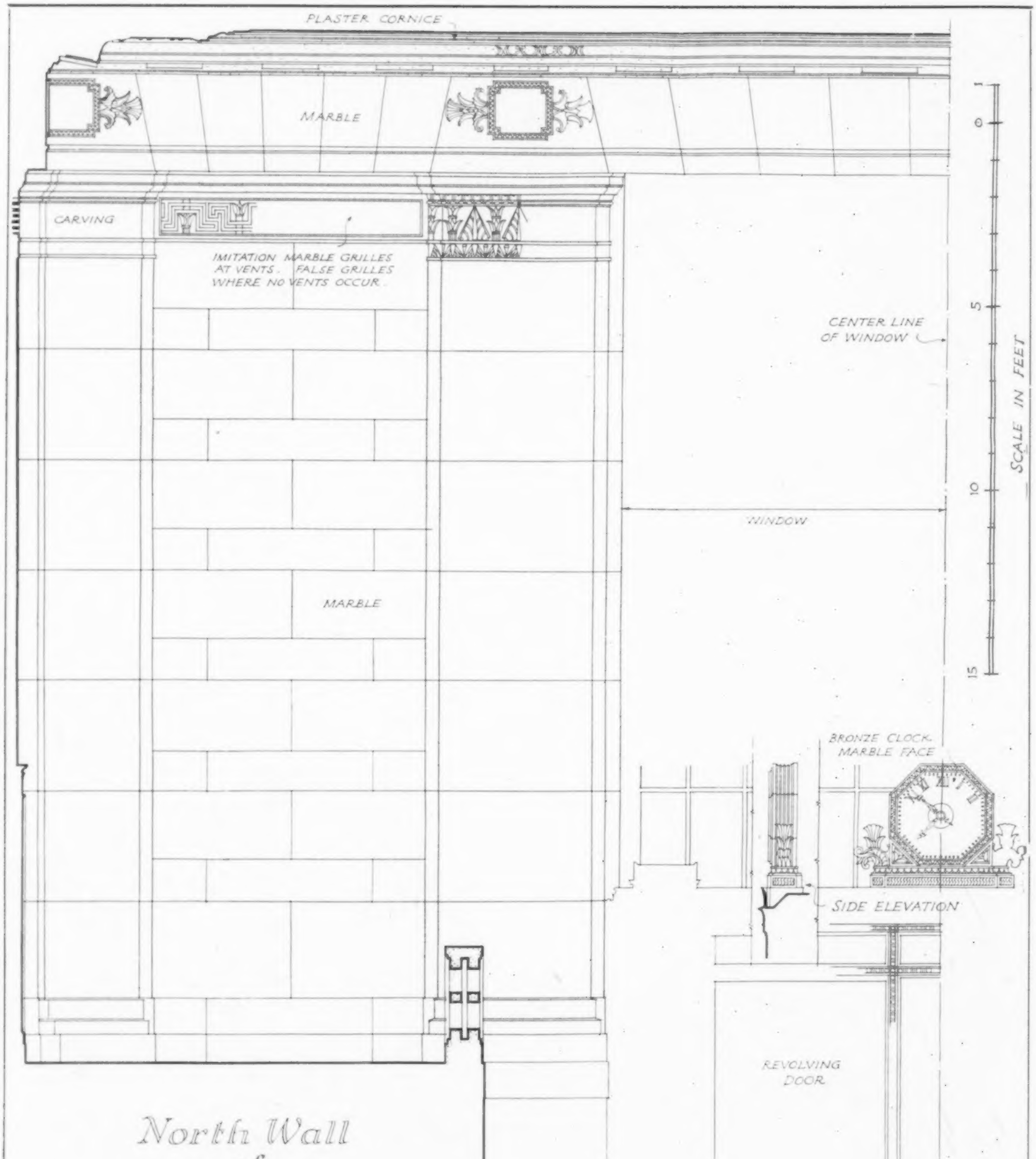
JULY 1929

No. 1

The ARCHITECTURAL FORUM DETAILS

Detail on Back

MAIN BANKING ROOM
CHASE NATIONAL BANK BUILDING, NEW YORK
GRAHAM, ANDERSON, PROBST & WHITE, ARCHITECTS



JULY 1929

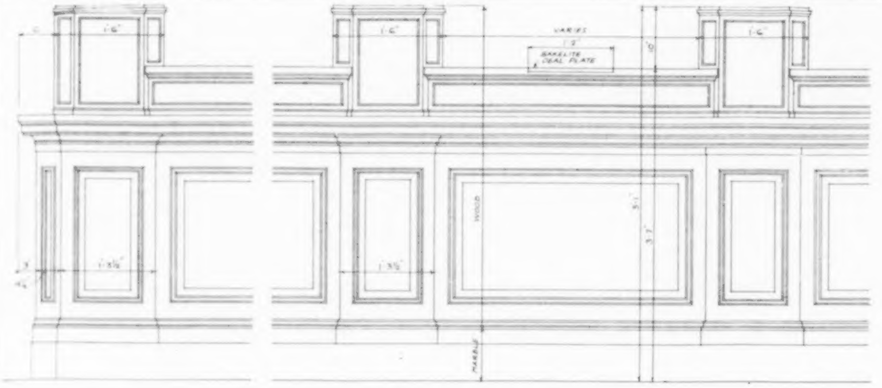
DETAIL, CHASE NATIONAL BANK BUILDING, NEW YORK
GRAHAM, ANDERSON, PROBST & WHITE, ARCHITECTS

No. 2

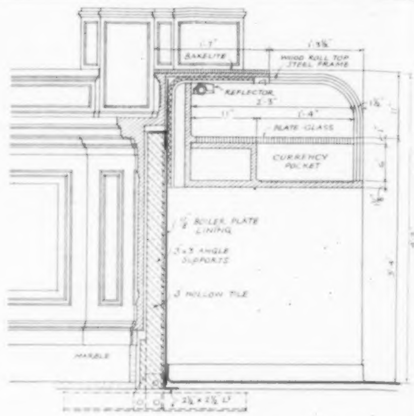
The ARCHITECTURAL FORUM DETAILS

Details on Back

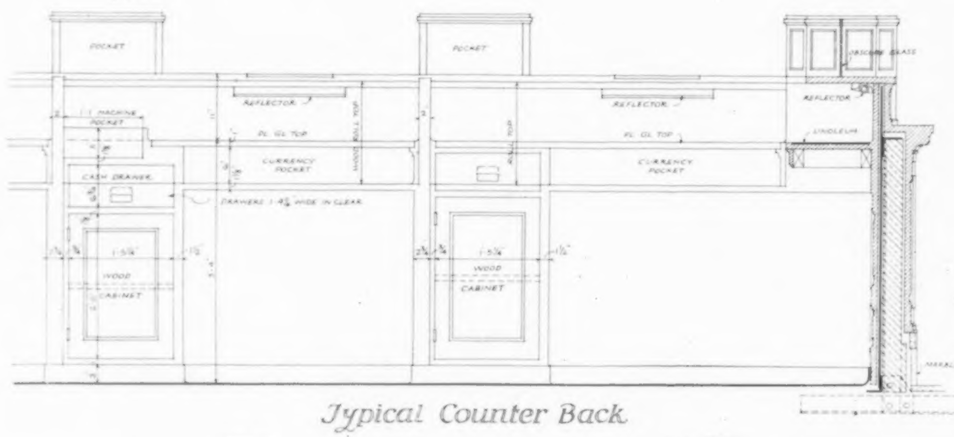
MAIN BANKING ROOM
CHASE NATIONAL BANK BUILDING, NEW YORK
GRAHAM, ANDERSON, PROBST & WHITE, ARCHITECTS



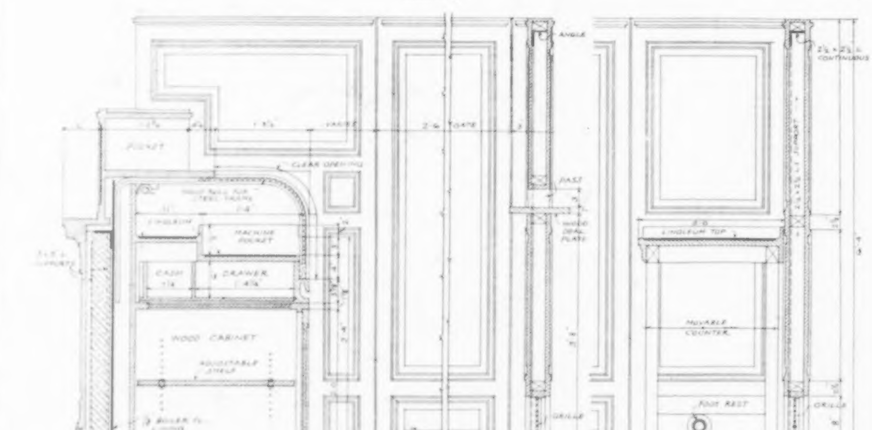
Typical Counter Front



Typical Section



Typical Counter Back



Typical Section Rear Screen Rear Counter

TYPICAL COUNTER SCREEN DETAILS

THE CHASE NATIONAL BANK BUILDING
NEW YORK CITY

JULY 1929

No. 3

1 0 5 10
SCALE IN FEET

DETAIL IN BOARD ROOM
CHASE NATIONAL BANK BUILDING, NEW YORK
GRAHAM, ANDERSON, PROBST & WHITE, ARCHITECTS

BOARD ROOM
CHASE NATIONAL BANK BUILDING, NEW YORK
GRAHAM, ANDERSON, PROBST & WHITE, ARCHITECTS

PRESIDENT'S OFFICE

RECEPTION ROOM

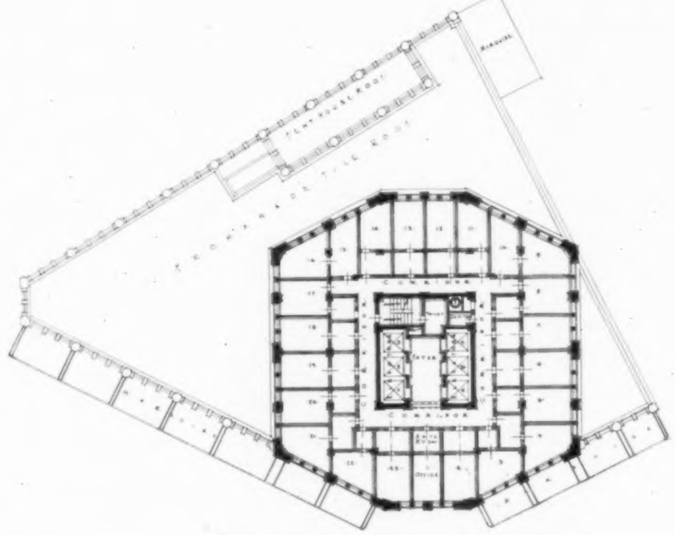
CHASE NATIONAL BANK BUILDING, NEW YORK

GRAHAM, ANDERSON, PROBST & WHITE, ARCHITECTS

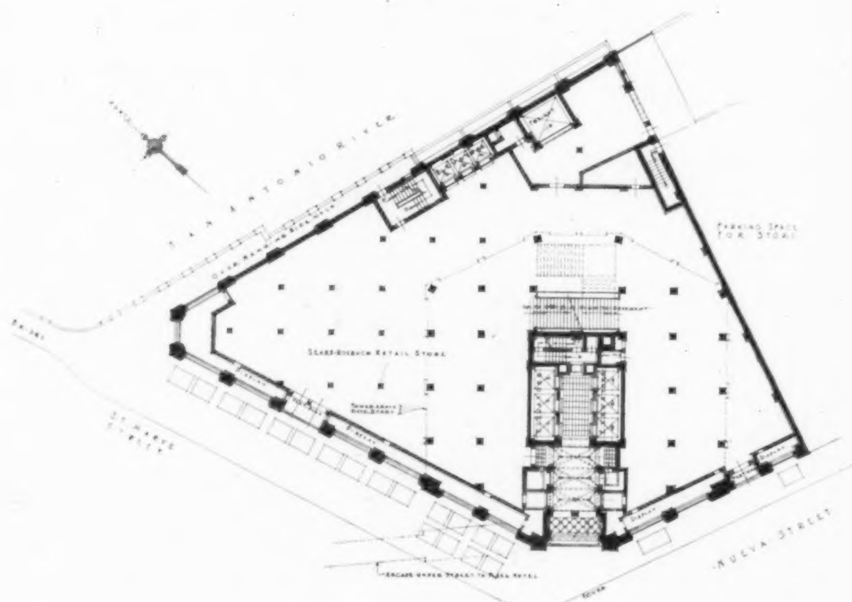
Photos. Harvey Patteson *Plans on Back*

SMITH-YOUNG TOWER BUILDING, SAN ANTONIO

ATLEE B. & ROBERT M. AYRES, ARCHITECTS

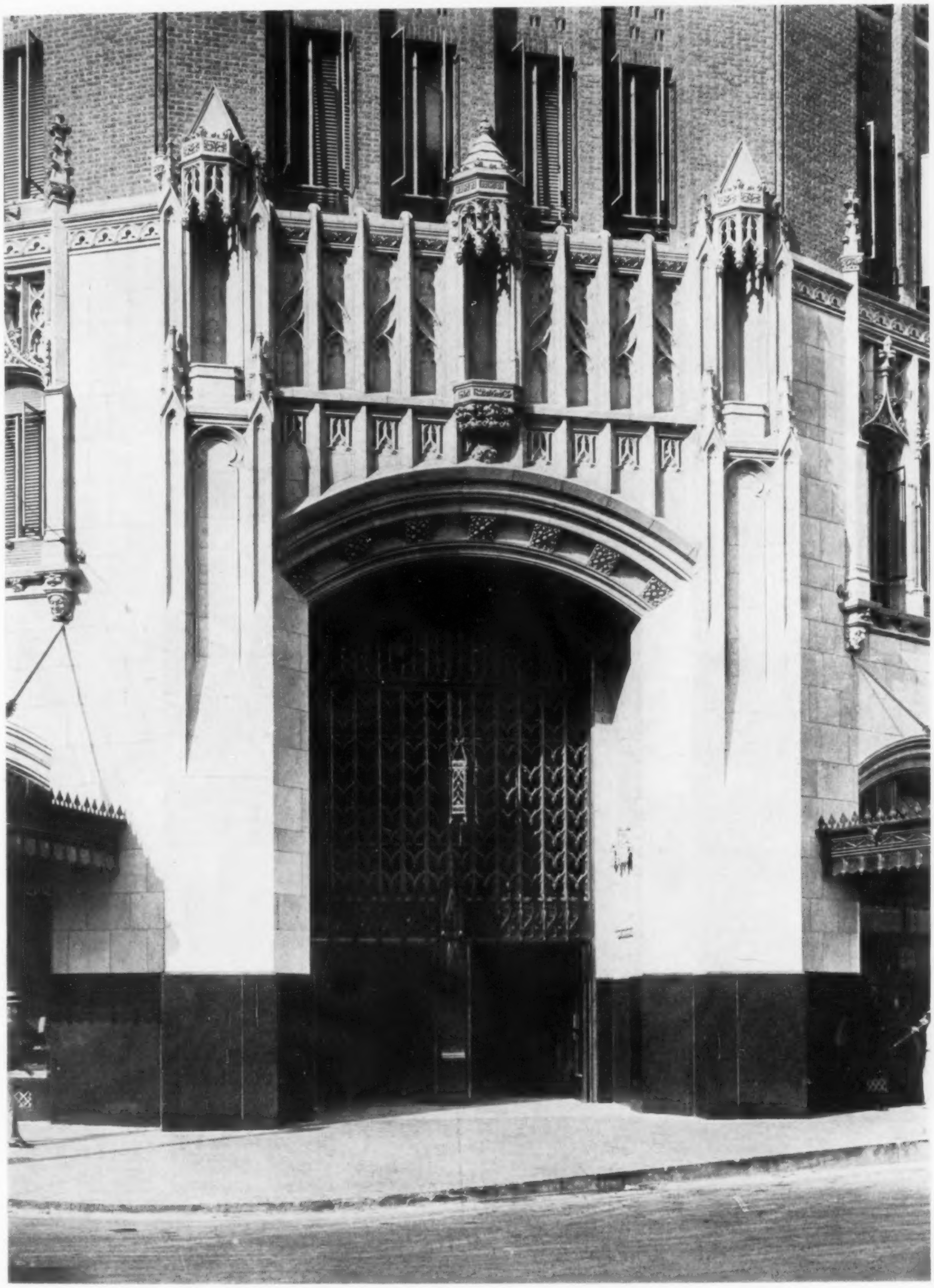


A TYPICAL OFFICE FLOOR

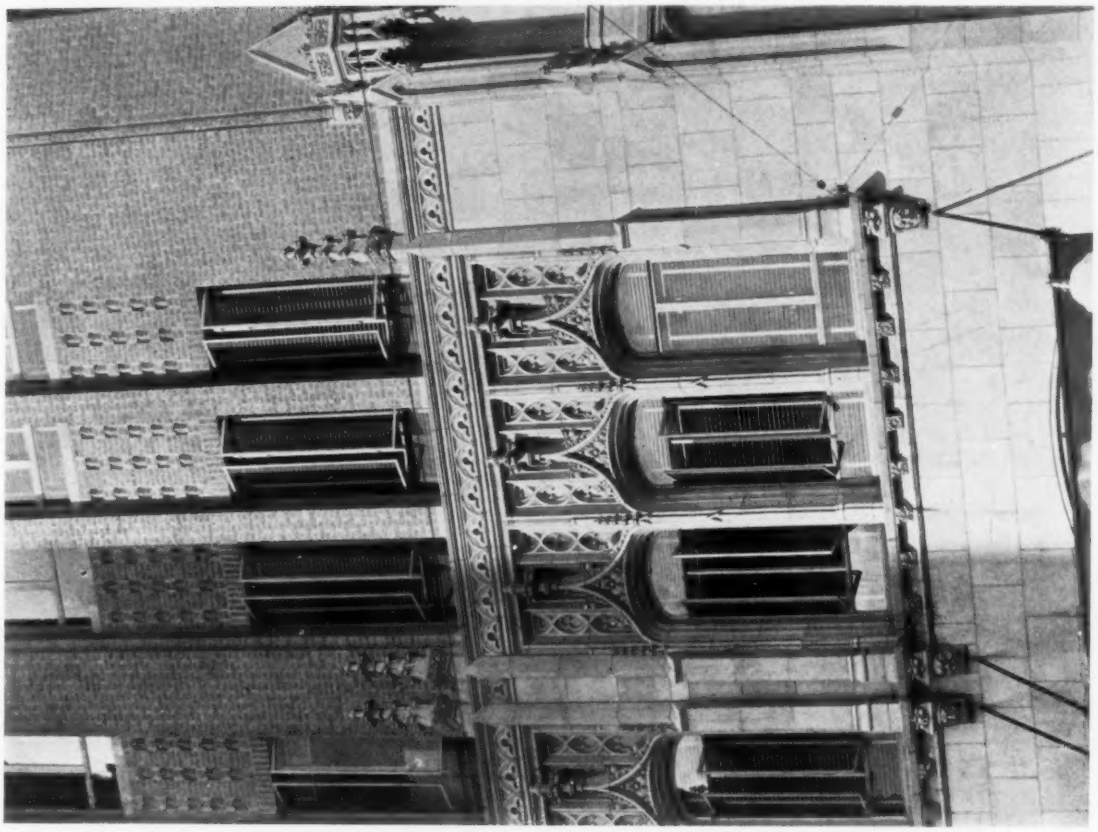


FIRST FLOOR

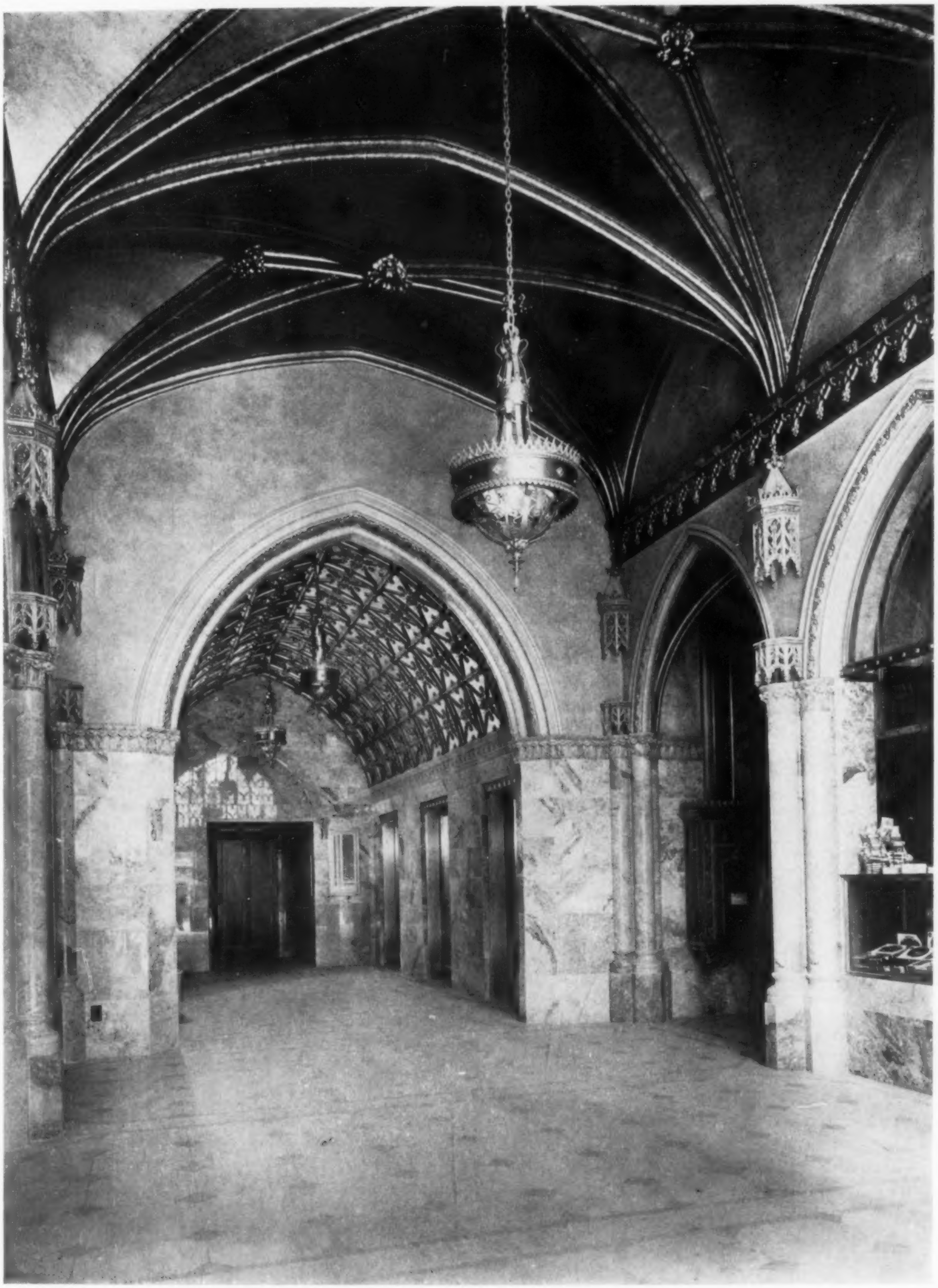
PLANS. SMITH-YOUNG TOWER, SAN ANTONIO
ATLEE B. & ROBERT M. AYRES, ARCHITECTS



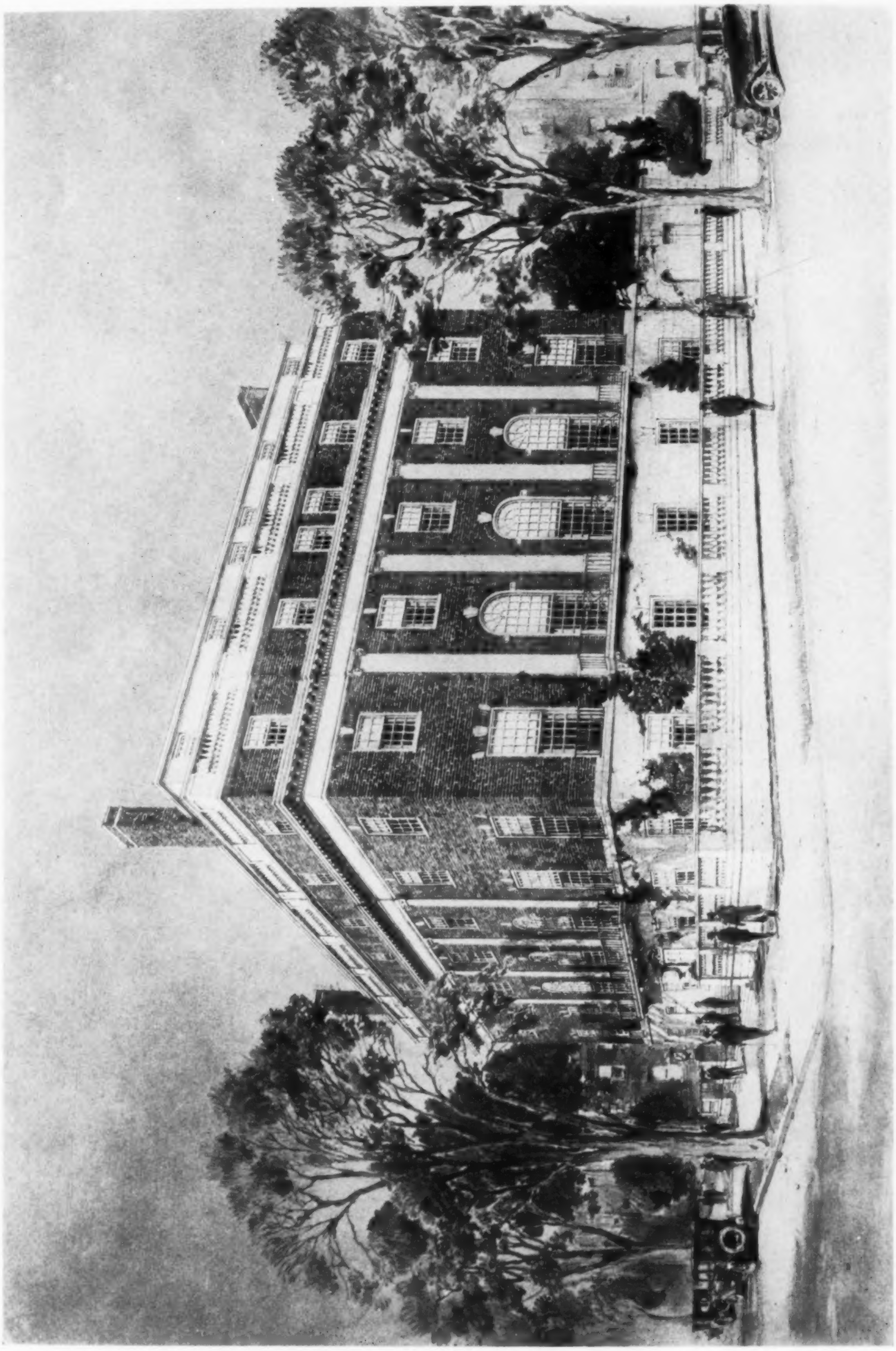
ENTRANCE, SMITH-YOUNG TOWER BUILDING, SAN ANTONIO
ATLEE B. & ROBERT M. AYRES, ARCHITECTS



DETAIL OF UPPER STORIES
SMITH-YOUNG TOWER BUILDING, SAN ANTONIO
ATLEE B. & ROBERT M. AYRES, ARCHITECTS

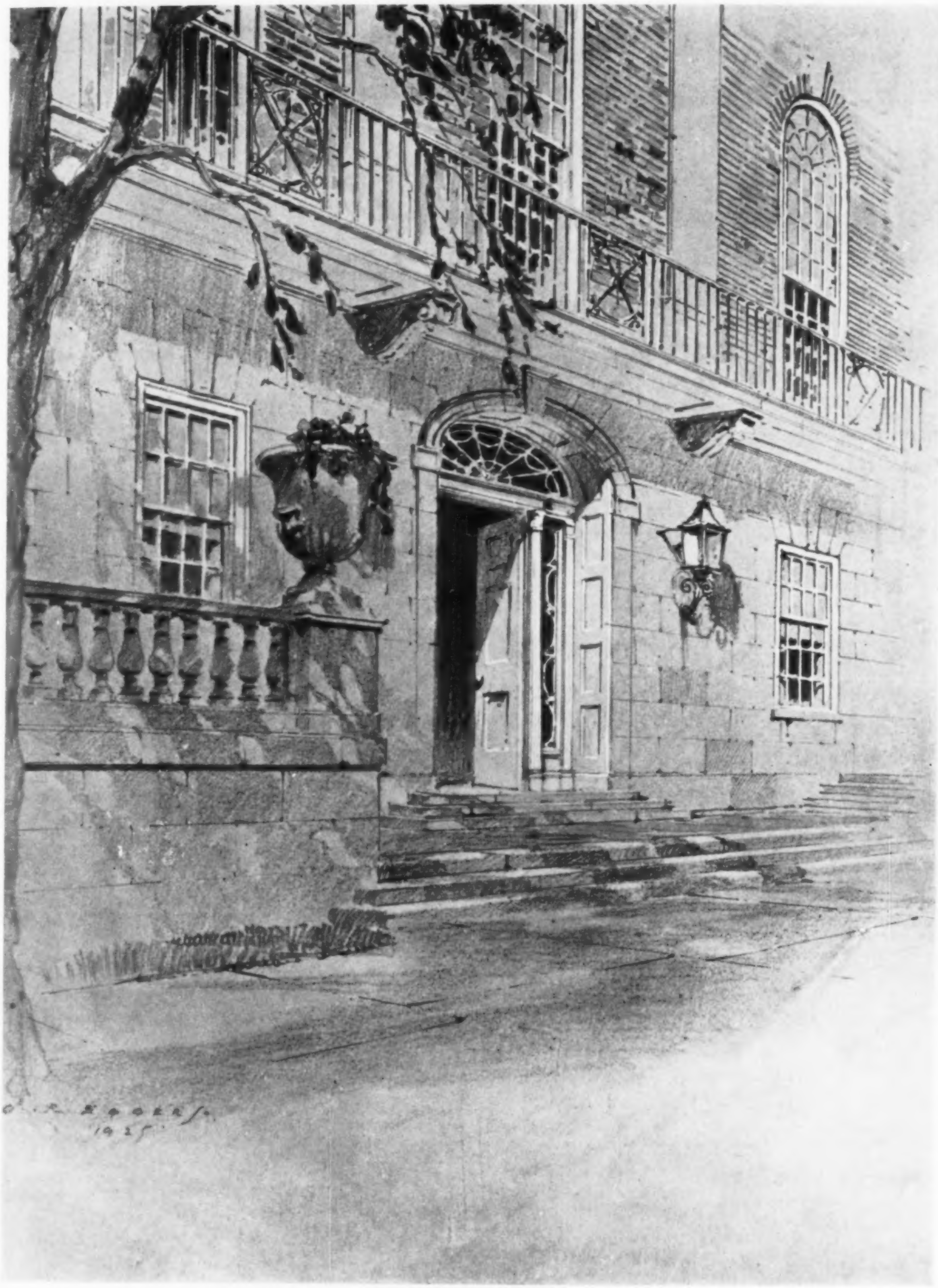


ENTRANCE LOBBY, SMITH-YOUNG TOWER BUILDING, SAN ANTONIO
ATLEE B. & ROBERT M. AYRES, ARCHITECTS

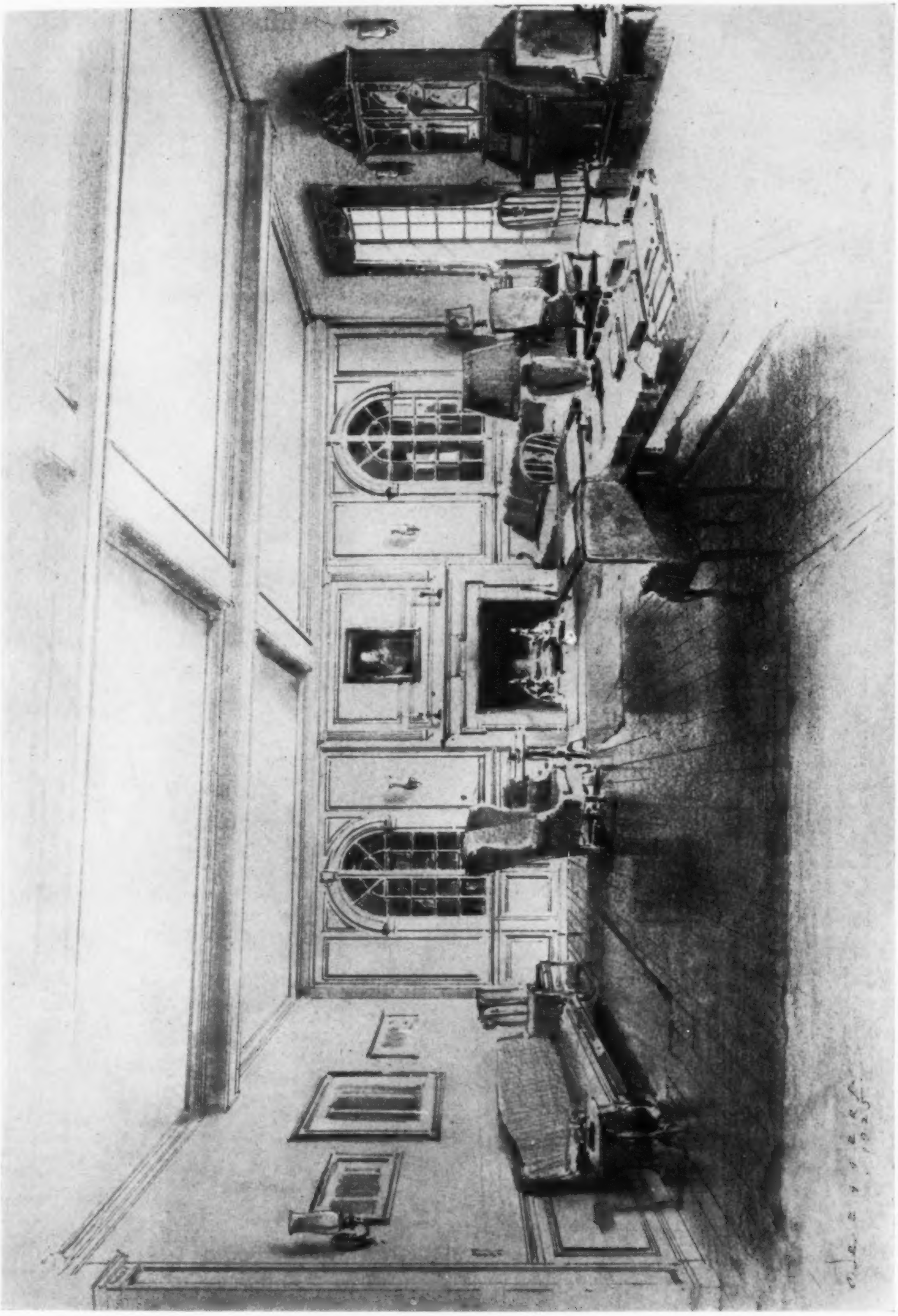


From Renderings by Otto R. Eggers

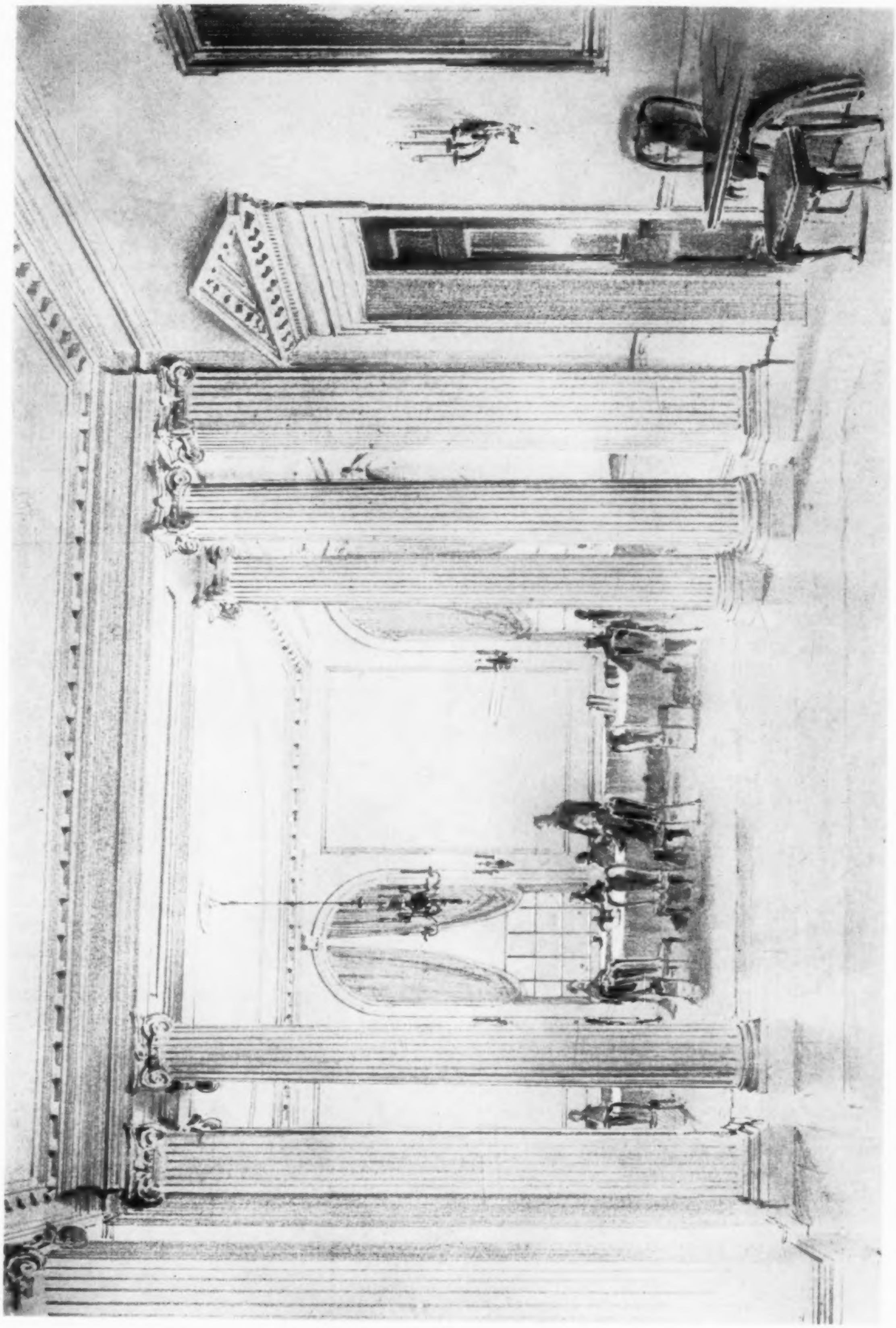
UNIVERSITY CLUB, MILWAUKEE
OFFICE OF JOHN RUSSELL POPE, ARCHITECT



ENTRANCE. UNIVERSITY CLUB, MILWAUKEE
OFFICE OF JOHN RUSSELL POPE, ARCHITECT



LIVING ROOM, UNIVERSITY CLUB, MILWAUKEE
OFFICE OF JOHN RUSSELL POPE, ARCHITECT



FOYER, UNIVERSITY CLUB, MILWAUKEE
OFFICE OF JOHN RUSSELL POPE, ARCHITECT

MODERN ARCHITECTURE IN GERMANY

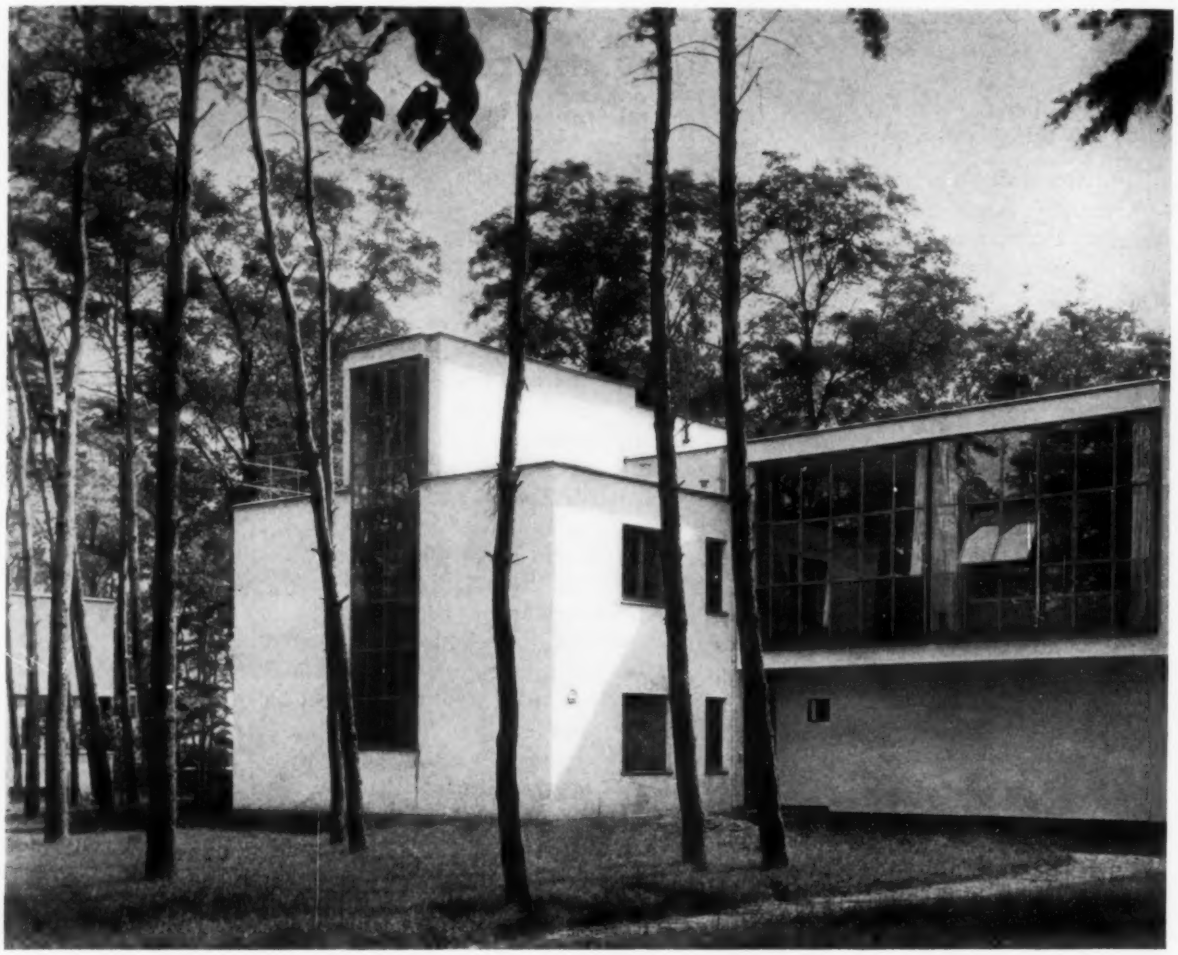
TEXT BY
EDWIN A. HORNER
PHOTOGRAPHS BY
SIGURD FISCHER

UPON crossing the border from Holland into Germany, one immediately realizes that there is a decided contrast in the prosperity of the two countries, as evidenced in the sudden change in the condition of the roads and the general aspect of disrepair prevailing in Germany. However, after proceeding farther into the country and visiting such cities as Hanover, Magdeburg, Berlin and Hamburg, this first impression gives way to a feeling of admiration for the manner in which the German people with their characteristic thoroughness and directness of purpose have been rehabilitating their country along modern lines, inspired by American methods of efficiency.

While the volume of new building in Germany is small in comparison to that of Holland, the same ideas of logic and simplicity are the underlying influences in the design, coupled with a necessary third,—economy. The results in many instances, where there has not been an extreme attempt to express the machine age in which we live, have been very good. We find also extremists who maintain that architecture is purely functional, that into it should be incorporated only the barest elements necessary to its functional purpose, and that it will eventually through a process of public education come to be regarded as beautiful for its simple truthfulness. While this theory of simple truthfulness may indicate a fundamental step in the evolution of a modern style of architecture, our own personal feeling is that such residences as those in Dessau by Walter Gropius are devoid of any element of charm which will cause them to endure as monuments of our age. The little residence of Carl Fieger, architect, in Dessau has somewhat the same aspect externally, but when one observes the interior features which literally express this machine age of ours, one sees a logically efficient plan which is commendable. The built-in buffet-closet between the kitchen and the living-dining room, so arranged that it eliminates the necessity of having a serving pantry and saves many steps for the housewife, is a feature that might well be adapted to our small house problem. The living room furniture is of tubular steel frames, the easy chairs having canvas seats and backs, as designed by Marcel Breuer of Dessau.

However, our chief interest is not in the residential architecture of Germany, for we Americans require something more than mere efficiency in a home. Among the best of the commercial buildings that we found is the *Anzeiger Hochhaus* in Hanover, home of the Hanover *Anzeiger* publications. The architect, Fritz Hoger of Hamburg, who is also architect of the *Chilehaus* in Hamburg, with which many of us are familiar, has used his favorite medium,—brick pattern work,—as the only form of ornamentation on the exterior. While the building is only ten stories high, with a "planetorium" dome superimposed, it has a decided vertical feeling, which is the essential point of emphasis in a tall building. There is current an opinion that tall structures framed with steel or reinforced concrete should be so designed as to express externally the actual methods of their construction, a theory which if exercised would produce as a result tiers of rectangular units laid horizontally, due to the fact that structural beams are longer than the story heights. This is the theory behind the design of Eric Mendelsohn's *Deukon Haus,* his alterations to the Rudolph Mosse Company's building, and his building for the C. A. Herpich Sohne department stores, all in Berlin. Personally, we are inclined to feel that the results thus achieved are not as pleasing as they might be, when one allows the mass and height of a structure to express the fact that it is made possible only by the use of steel or reinforced concrete, with the resultant height emphasized in the design by vertical lines as has been done with the *Anzeiger Hochhaus.* The interiors of this building are carried out in the same spirit of simplicity that we find throughout Dutch and German architecture. The directors' room is done in plain oak surfaces in alternating dark and light bands, with very few mouldings, such as there are being square in contour and in scale with the plainness of the room. A simple beamed ceiling, lighting fixtures treated in straight lines, and floor and table tops done in parquetry carry out the spirit of the room. On the roof is the "planetorium," a large hemispherical dome under which is a projecting machine to reproduce the various constellations of the heavens on the white "sky," used for public lectures on astronomy.

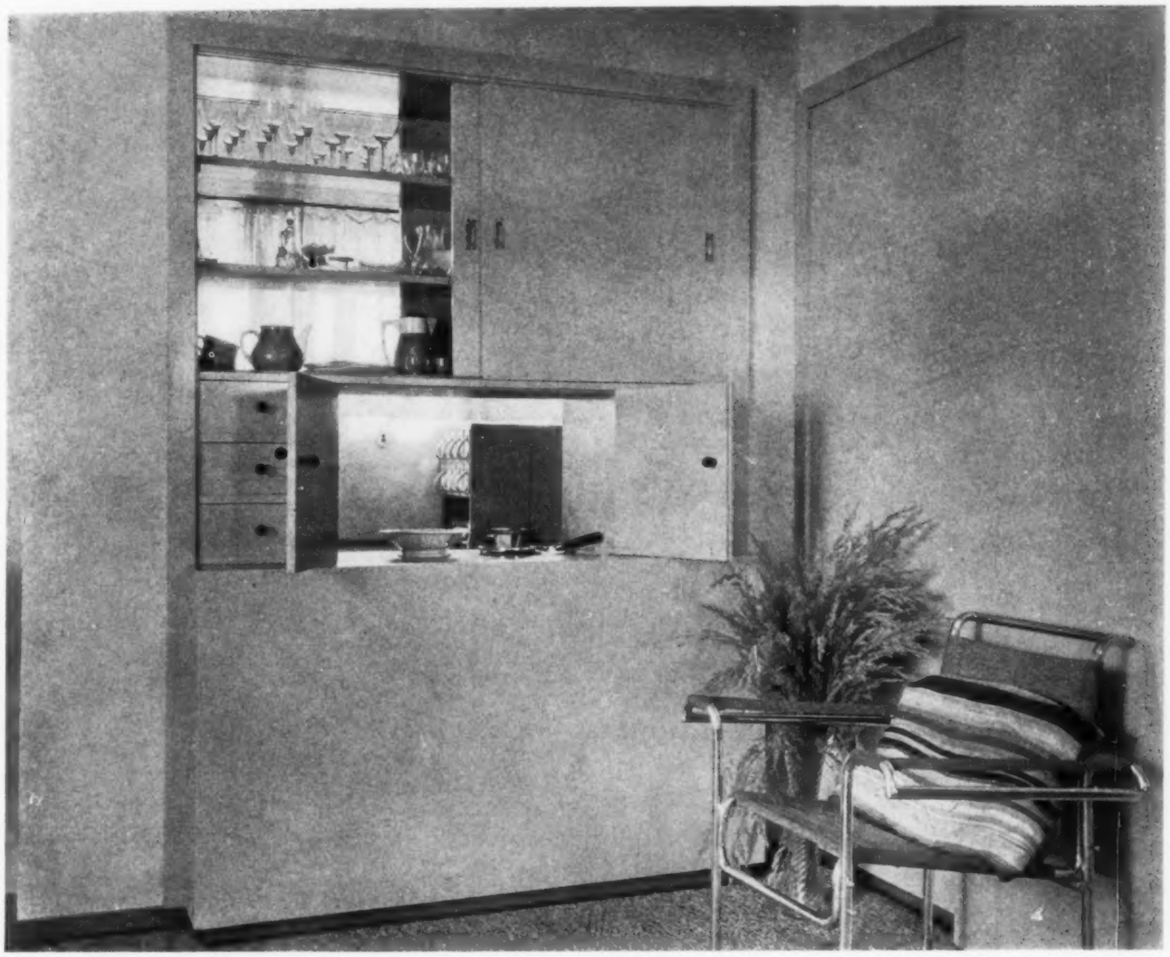
Another very good *hochhaus,* or high building, is the *Ballinhaus* in Hamburg by Hans Oskar Gerson. The elevations are very plain with the exception of a few sculptured figures, the chief interest being in the handling of corners and offsets. In Dessau we find another example of extreme modernism in the *Bauhaus* by Walter Gropius. The *Bauhaus* is a school of architecture, or "architect factory," as it were. Although well planned and excellently lighted, we hesitate to predict the future of architecture inspired by such



Professor's Residence, Bauhaus, Dessau
Walter Gropius, Architect

academic surroundings. Contrasted to this is the *Stadthalle* in Magdeburg by Johannes Goederitz, together with its adjacent group of exposition buildings by Albin Muller. Here we have good creative design, simply and economically done, and with excellent effect. Here again we have an interesting use of brick and terra cotta forming the only exterior ornamentation, with a result that is not spotty and which for that reason is more effective than the *Anzeiger Hochhaus.* The interior of the great assembly hall is treated with alternating dark and light bands above the balcony, with a herringbone pattern executed in beaded wainscot stock below and on the rail of the balcony. The lighting fixtures are extremely simple, consisting of three plain white globes suspended at varying heights, each from a single conduit cord, the three being linked together to form a unit. The exposition buildings, in all their plainness, are most excellent in their proportions. One experiences a thrill of delight upon seeing the whole ensemble illuminated at night by the strangely grotesque lighting fixtures which flank the great central paved court of the group.

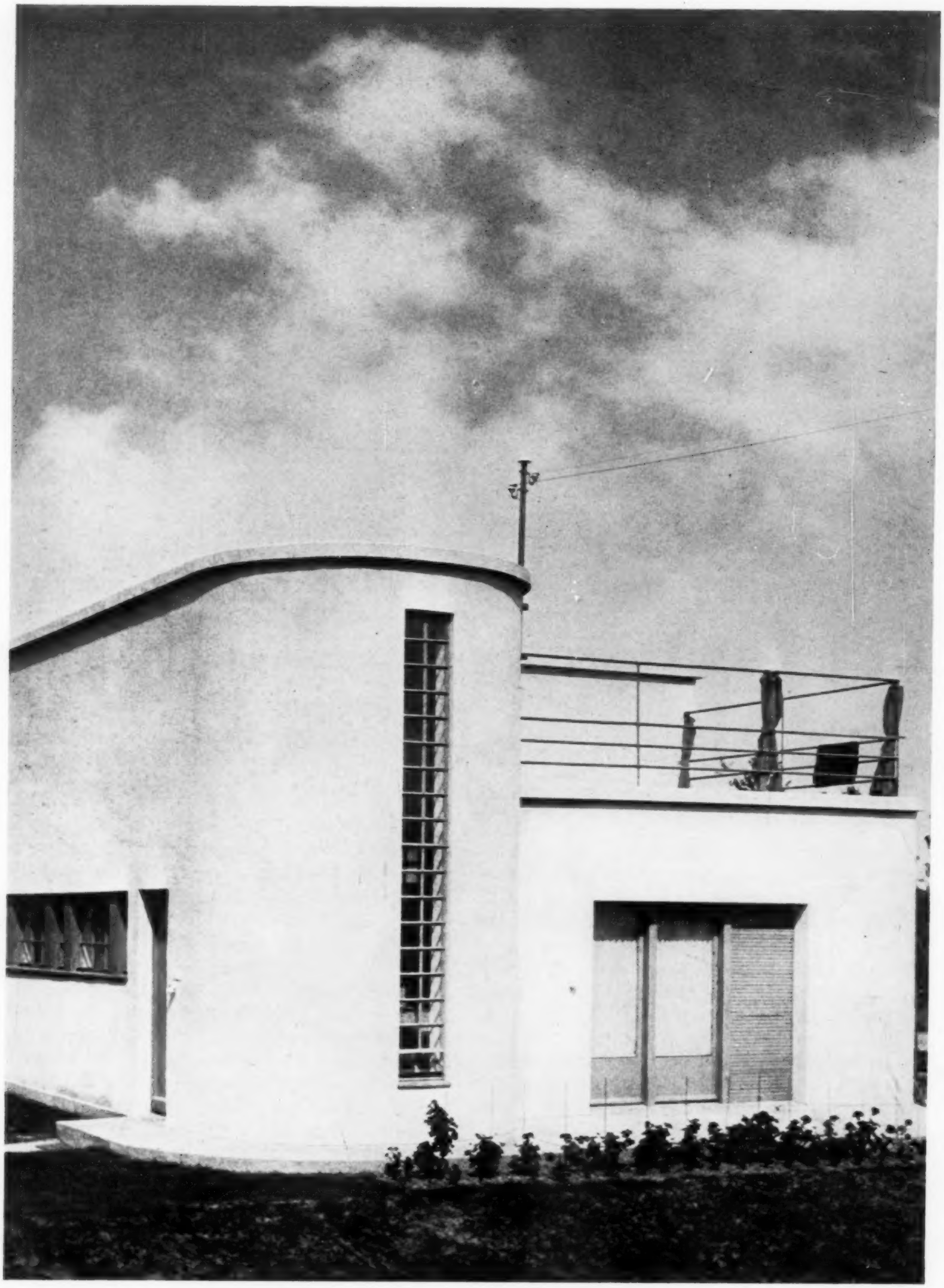
In Berlin we find another very good example of effective lighting in the Titania motion picture theater. Schoffler, Schonbach & Jacoby are the architects. The alternating dark and light bands which treat the exterior of what perhaps may be a ventilating shaft are illuminated in a way that is not at all unpleasant. We might say, without intending a pun, that the design is quite theatrical, but excellent advertising. The little *Kirche auf dem Tempelhofer Feld* in Berlin, designed by Stadtbaurat Brauning, now dead, illustrations of which appeared in the April issue of The Forum, is a charming example of modern German ecclesiastical architecture. Externally there is no attempt at ornamentation with the exception of the metal-covered bell cupola which is done in delicate simplicity. The church is circular in plan, a fact which accounts for its peculiarly interesting interior. Around the perimeter of the auditorium is a single row of columns which serve the double function of supporting the balcony and also the ceiling of the auditorium. These columns are plain ten-sided shafts with neither caps nor bases, the corners of



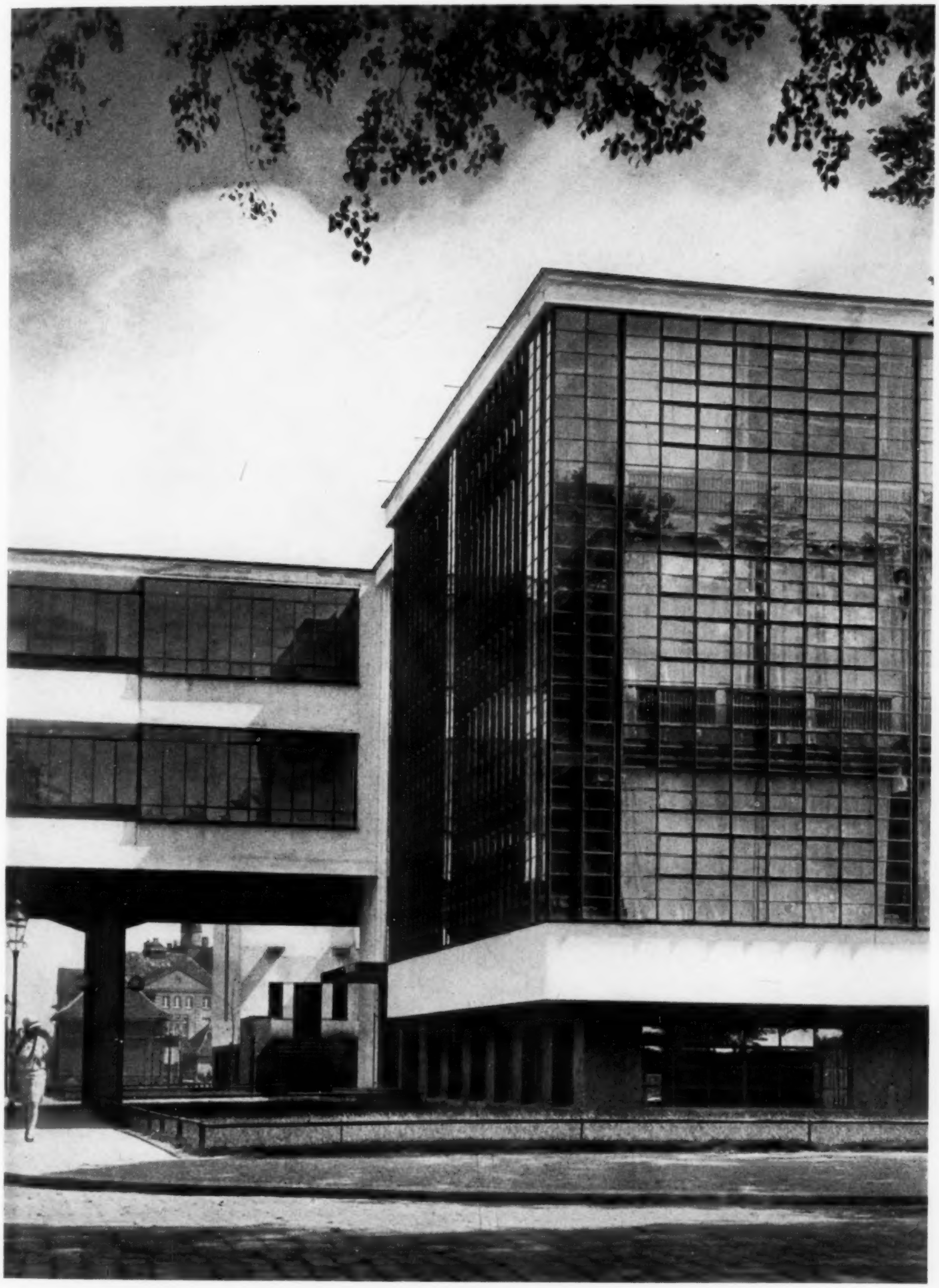
Kitchen Dresser. Residence of Carl Fieger, Dessau
Carl Fieger, Architect

the shafts merging into the channels between the ribs of the intricate system of plaster vaulting. The ceiling is not unusual in its treatment, the ribs of the intricate design springing from the faces of the column shafts, flowing in graceful curves to converge at the center into a flower of many petals. The entire ceiling is white, depending for its interest on the play of light and shade in diamond-shaped coffers covering the surface.

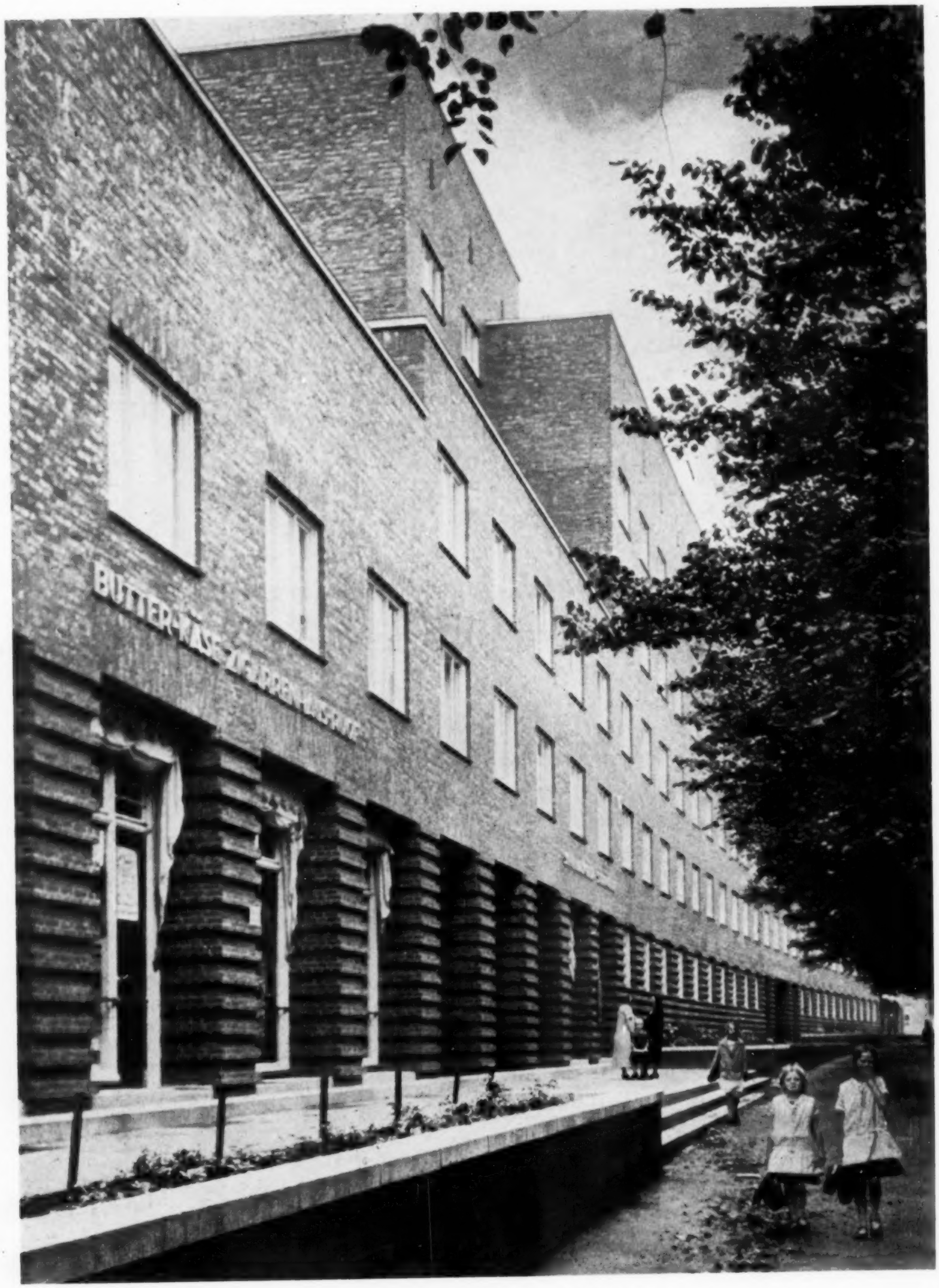
Two buildings somewhat similar in purpose but very unlike in their design are the structure for the *Verband der Deutscher Buchdrucker* (German Bookprinters Labor Union) and that for the *Ullstein Druckhaus,* both in Berlin. The former was designed by Max Taut, the latter by E. G. Schmohl. The *Verband der Deutscher Buchdrucker* building is of interest chiefly for its interiors which, though quite plain, are at the same time unusual. The assembly hall on the top floor has a wall treatment of flush woodwork, a herringbone effect being worked out by varying the direction of the grain in the veneer. The only interruptions in the plain wall surfaces are the window reveals and the ventilating louvers over doors and closets. Ceiling beams framing a hip roof are exposed as part of the design. The lighting fixtures, which are a bit restless in a room of such otherwise simple treatment, give the only disturbing element. The principal stair hall is treated with tile wainscoting to the ceiling, the colors being those of the new German Republic,—black, red and yellow. On the ground floor, as one approaches the stairway, one is confronted with a modernistic conception of the official coat of arms of the society executed in metal in high relief. The elevator enclosure is of glass set in a bronze framework, and the elevator itself is automatic, operated without an attendant. This type of elevator is commonly used in business and hotel buildings on the continent in cases where the volume of traffic does not warrant having an operator. Occasionally also one finds a type of continuously moving elevator operating in such a way that a chain of cars goes up one shaft, over a system of rollers, and down an adjacent shaft, each shaft opening into the corridor, so that a passenger need only step into the car of his choice. In spite of the use of carefully arranged



RESIDENCE OF CARL FIEGER, DESSAU
CARL FIEGER, ARCHITECT

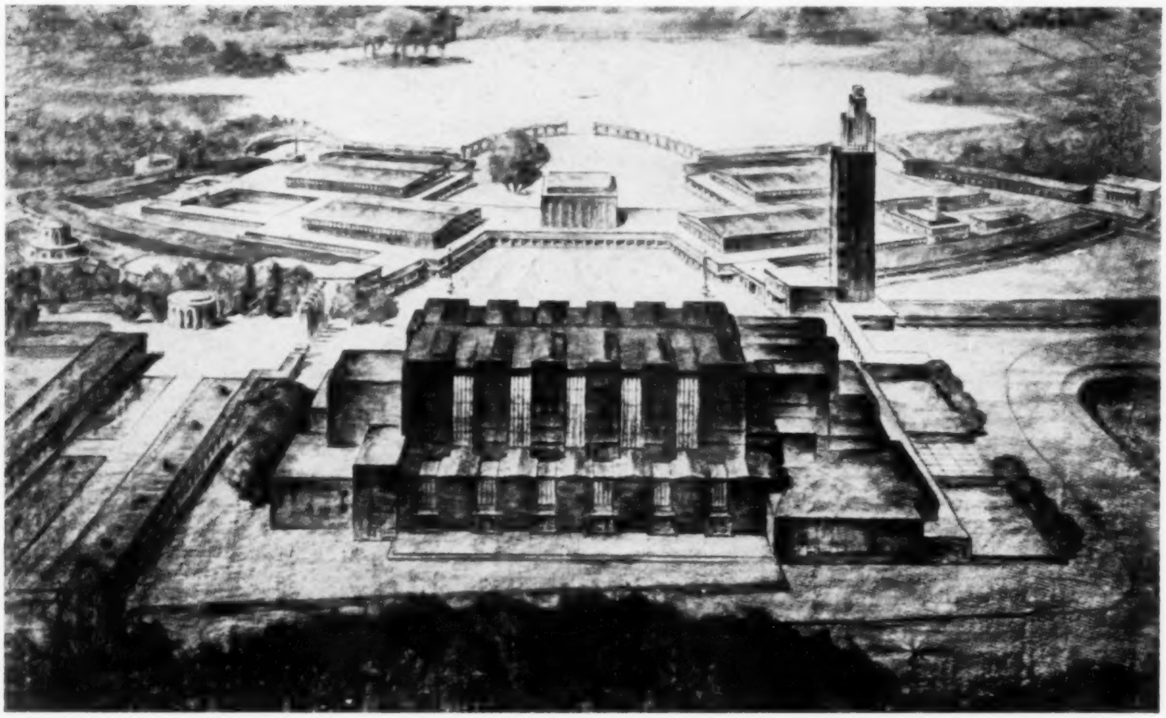


BAUHAUS, SCHOOL OF ARCHITECTURE, DESSAU
WALTER GROPIUS, ARCHITECT



AN APARTMENT HOUSE, HAMBURG

COURT, APARTMENT HOUSE, HAMBURG



Stadthalle Magdeburg
Johannes Goederitz, Architect
Exhibition Buildings in Background, Albin Muller, Architect

safety devices, however, it is at best hazardous.

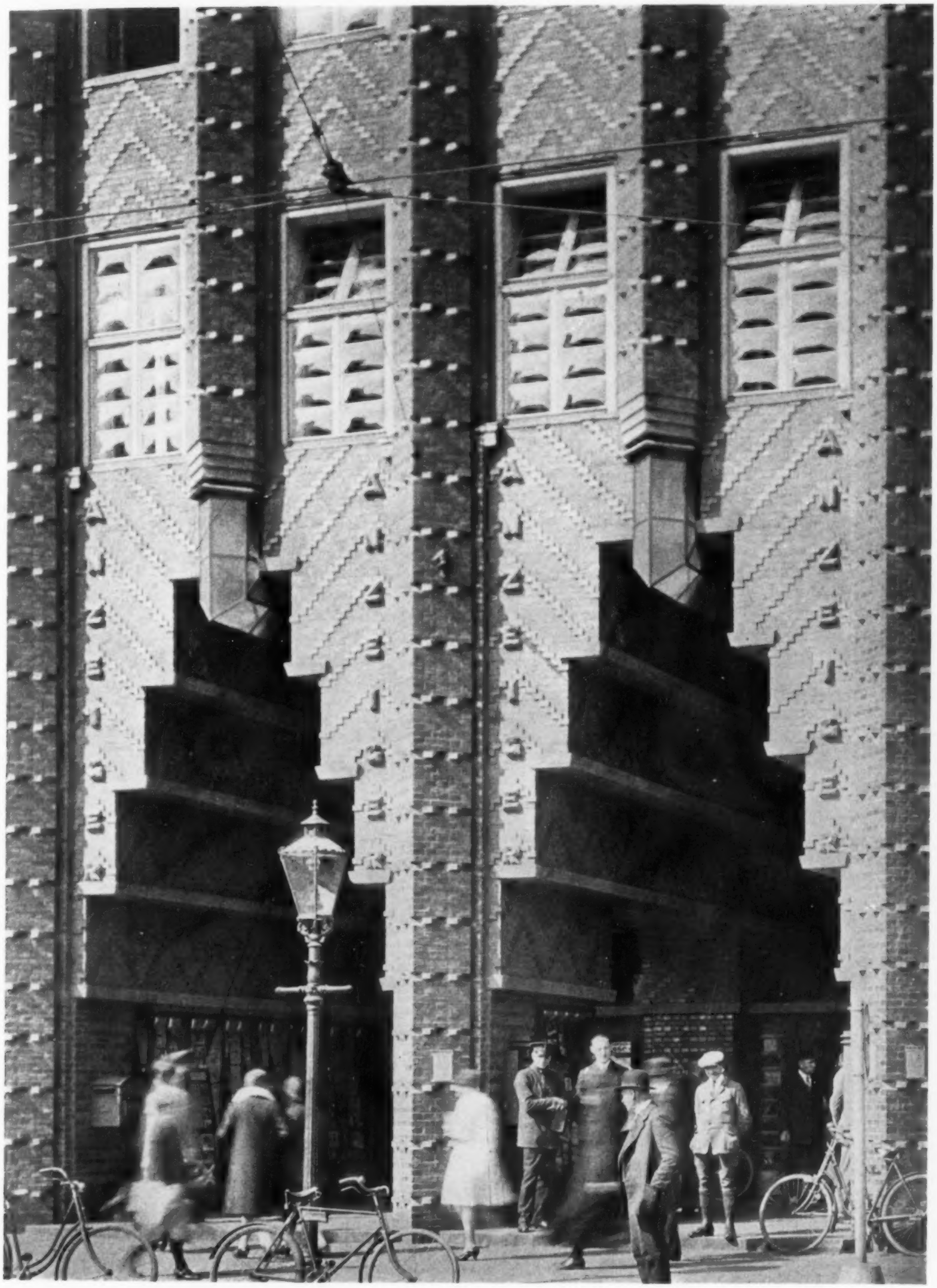
The *Ullstein Druckhaus*, already mentioned, is one of the best of the new buildings in Berlin. It houses the activities of a very large publishing company, and within its walls are carried on all the processes required by the printing industry. We were cordially received and conducted through the entire building, from basement to roof. Entering the great lobby one is immediately impressed by its simple grandeur. The reader may tire of the reoccurrence here of the word "simple"; nevertheless, simplicity is the keynote of all the best continental European architecture of today. There is no need to continue the application of antedated forms because of their historic excellence, when a straightforward use of the materials best adapted to solving the problem can produce such pleasing results as we have seen throughout Holland and Germany. However, lest we be misunderstood, let us repeat the statement made in a previous article, that in Denmark and Sweden we find a modernism based on classicism, but not by rote or formula.

Other architectural features of interest in the interior of the *Ullstein Druckhaus* are the heavy wrought iron covered doors leading from the principal corridors to all rooms of importance, and the unusual method of lighting the main stair shaft with a heavy wrought iron fixture suspended from the topmost ceiling with globes, or rather with lanterns, interspersed at each story. In the basement there is a restaurant with an outdoor arcade and terrace where employes may obtain lunch if they wish and where they may enjoy their occasional glasses of beer during working hours. It might be noted that the more attractive portion of the dining room facing the arcade, and the arcade itself, are reserved for the laboring employes rather than for executives. One is impressed by the excellent scale and taste used throughout this building and is inclined to wish for more of both in architecture as a happy medium between extreme modernism and ultra-conservatism.

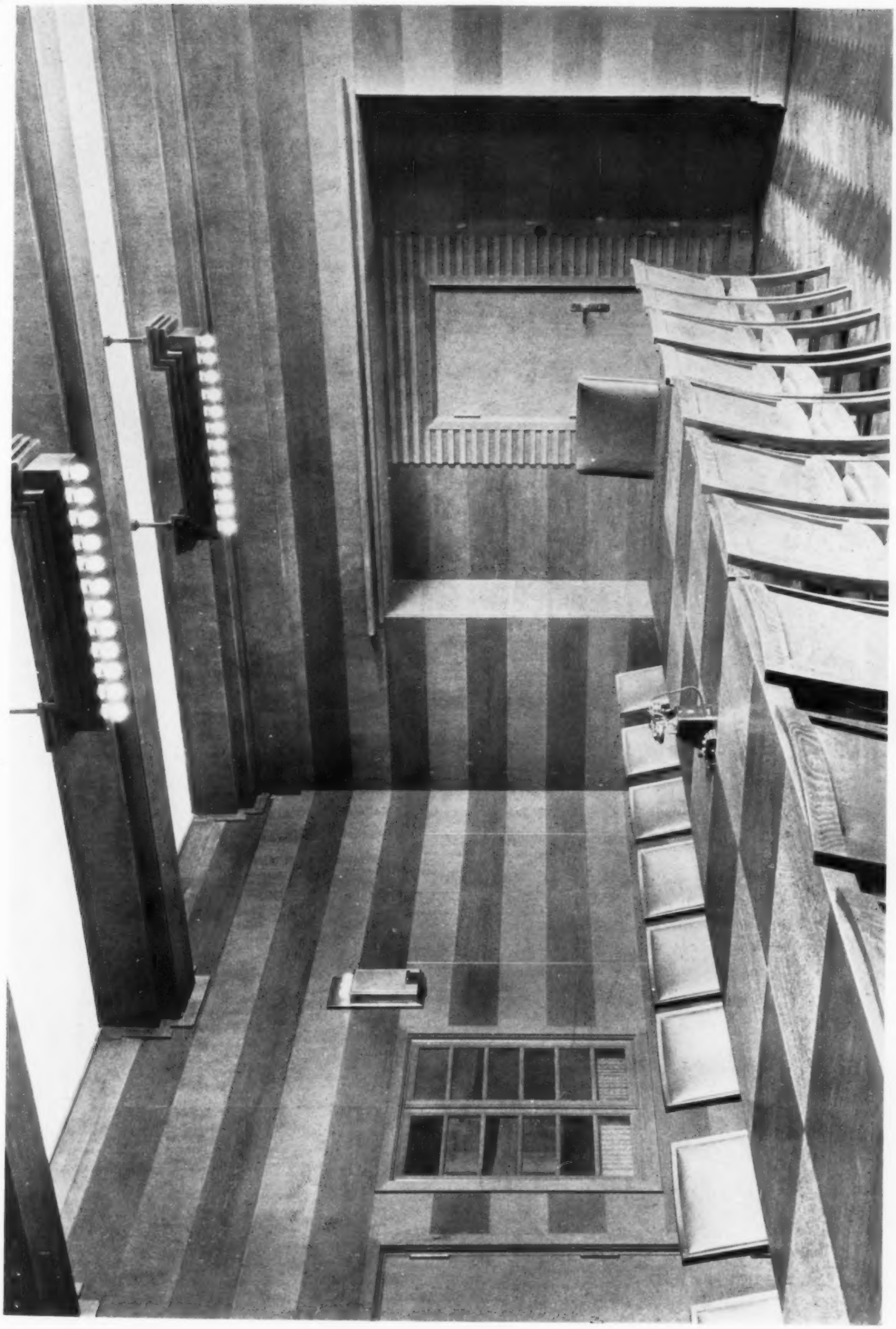
In subsequent articles of this series we shall deal with modern Danish and Swedish architecture. In both countries one finds a modernism based on classic precedent, but a classicism which is used with structural logic. And here again one finds logic, simplicity and restraint in the creation of new forms with classic feeling playing important roles in the creation of architecture that is refreshing and inspiring without being freakish.

Editor's Note. This is the second article in the series on modern European architecture which were written for The Architectural Forum by Edwin A. Horner during his trip abroad a year ago this summer. On this trip Mr. Horner accompanied Sigurd Fischer, the well known architectural photographer, who took for special publication in The Forum a series of remarkable photographs of some of the best examples of modern architecture in Europe.

HANOVER ANZEIGER BUILDING
FRITZ HOGER, ARCHITECT



ARCADES AT ENTRANCE, HANOVER ANZEIGER BUILDING
FRITZ HOGER, ARCHITECT



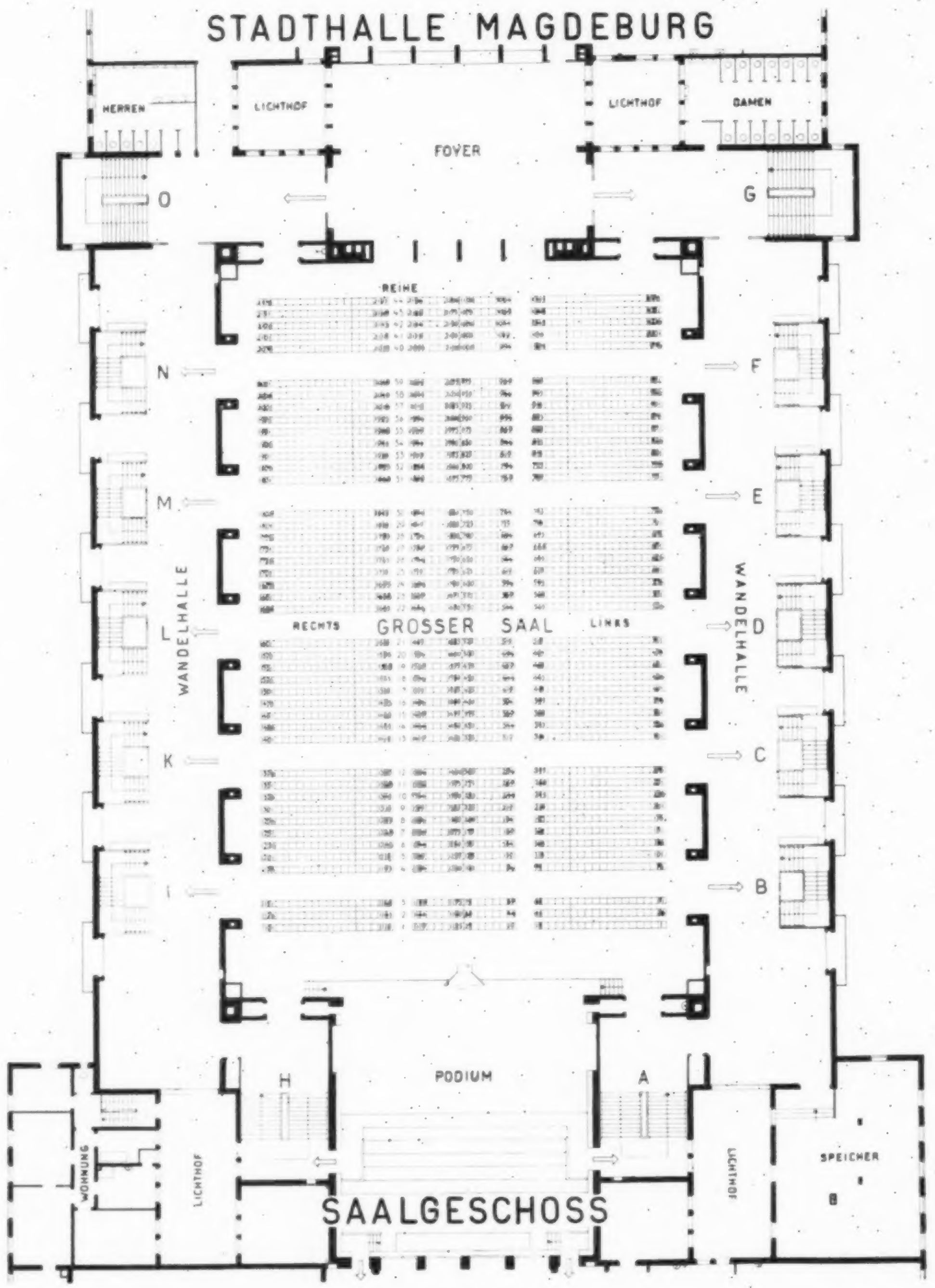
BOARD ROOM, HANOVER ANZEIGER BUILDING
FRITZ HOGER, ARCHITECT

BALLINHAUS; CHILEHAUS IN BACKGROUND, HAMBURG
HANS OSKAR GERSON, ARCHITECT

DOORWAY, BALLINHAUS, HAMBURG
HANS OSKAR GERSON, ARCHITECT

STADTHALLE, MAGDEBURG
JOHANNES GOEDERITZ, ARCHITECT

Plan on Back

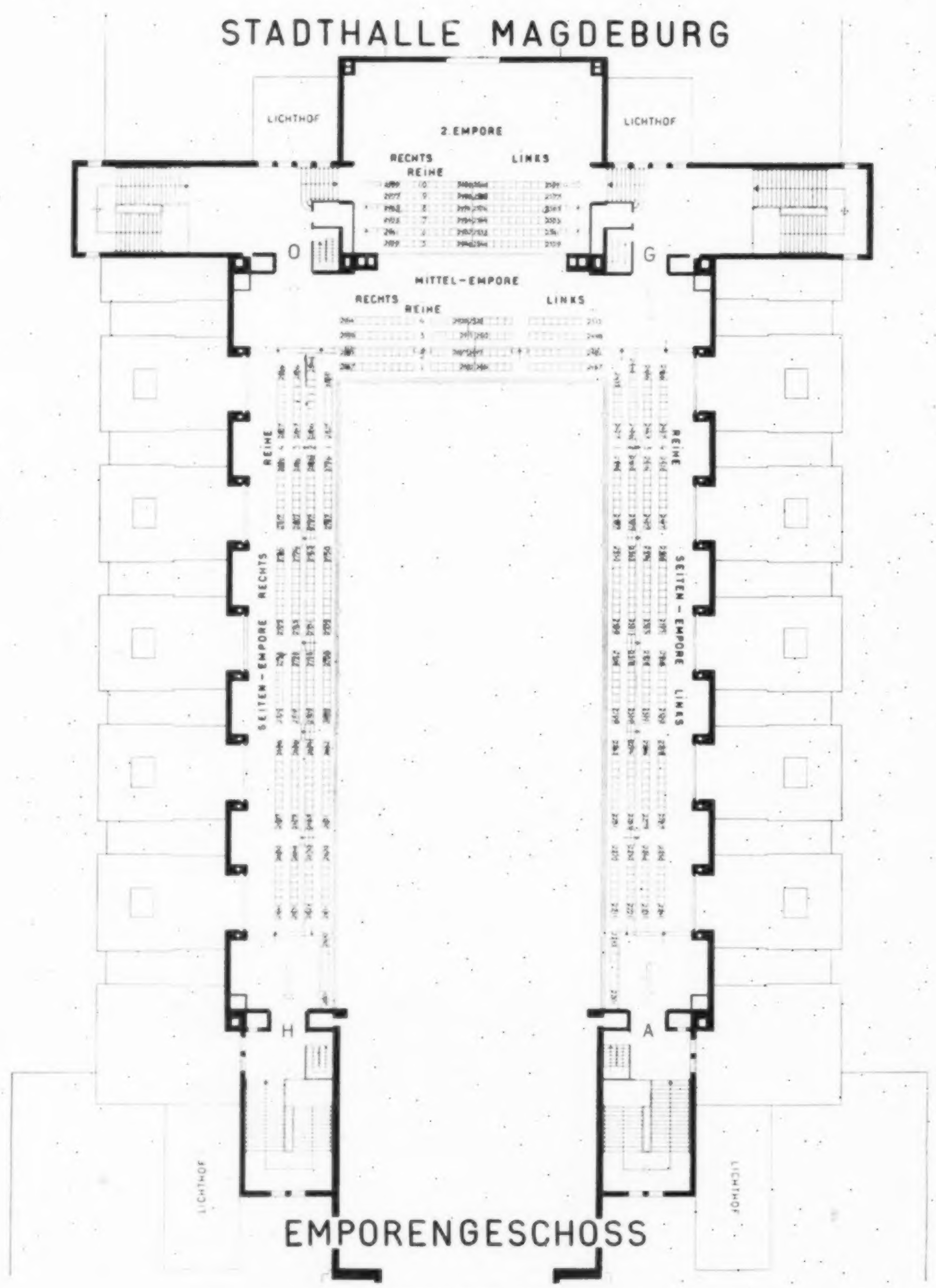


FIRST FLOOR

PLAN, STADTHALLE, MAGDEBURG
JOHANNES GOEDERITZ, ARCHITECT

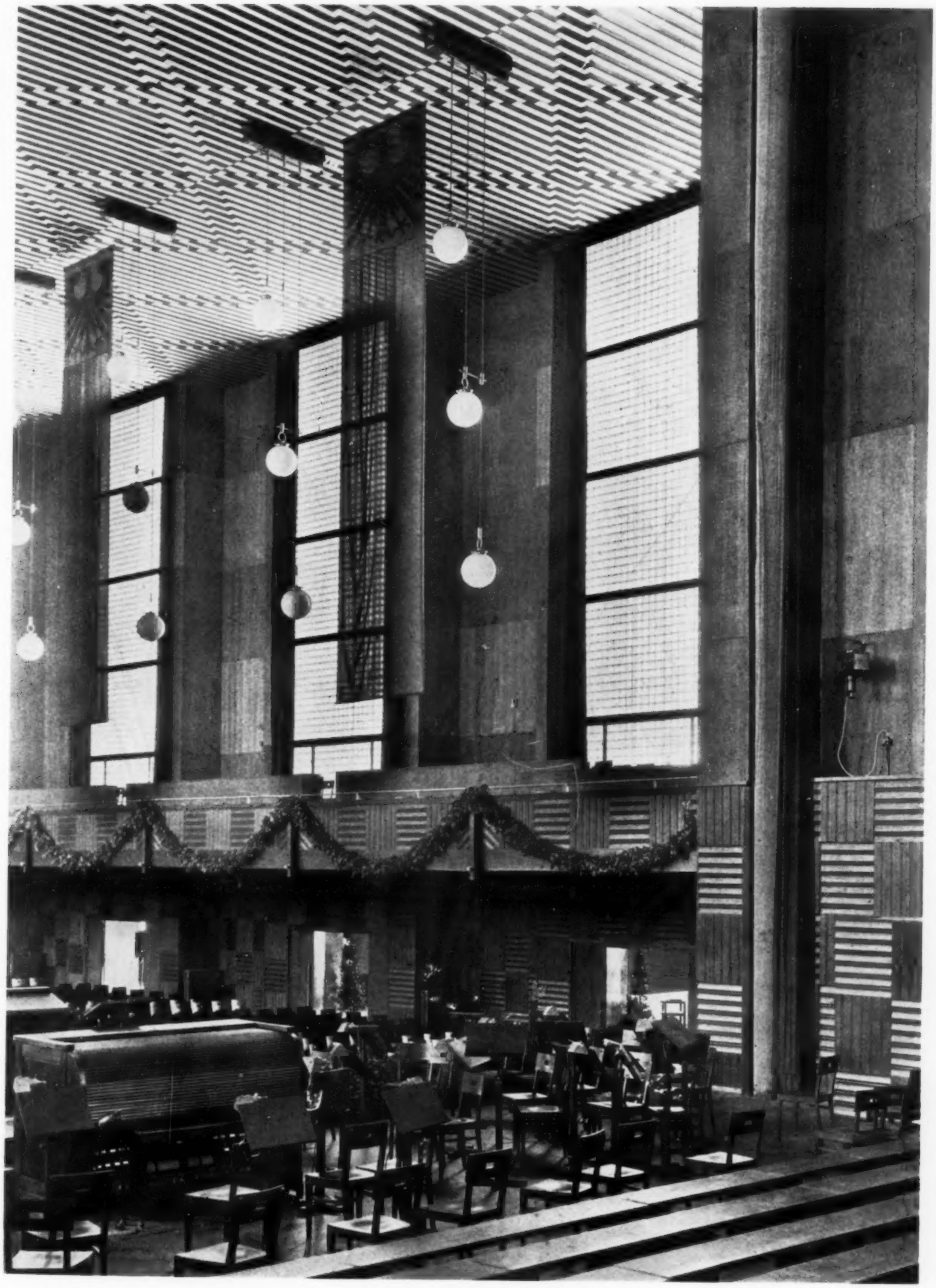
Plan on Back

FRONT ELEVATION, STADTHALLE, MAGDEBURG
JOHANNES GOEDERITZ, ARCHITECT

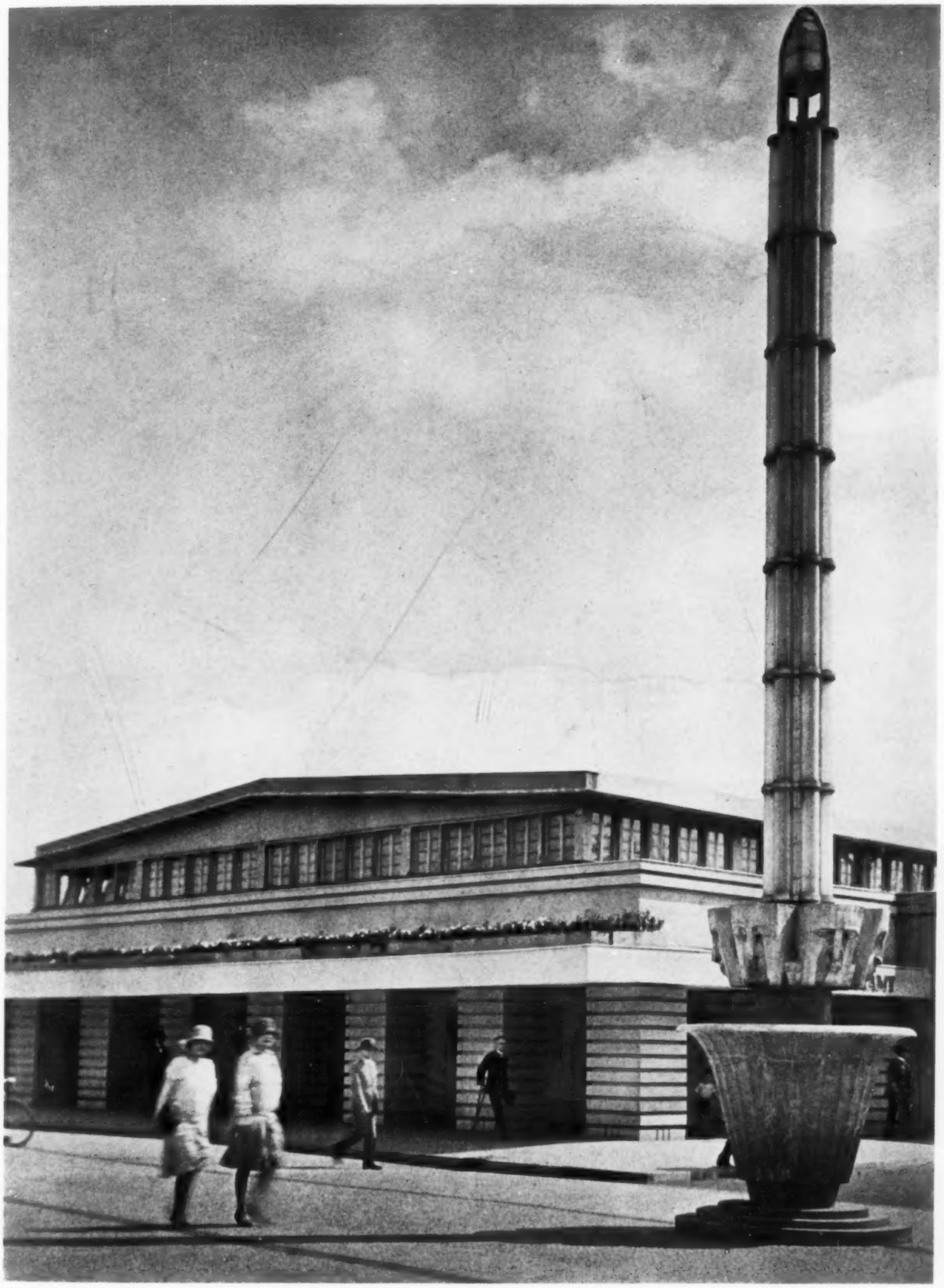


SECOND FLOOR

PLAN. STADTHALLE, MAGDEBURG
JOHANNES GOEDERITZ, ARCHITECT



AUDITORIUM, STADTHALLE, MAGDEBURG
JOHANNES GOEDERITZ, ARCHITECT

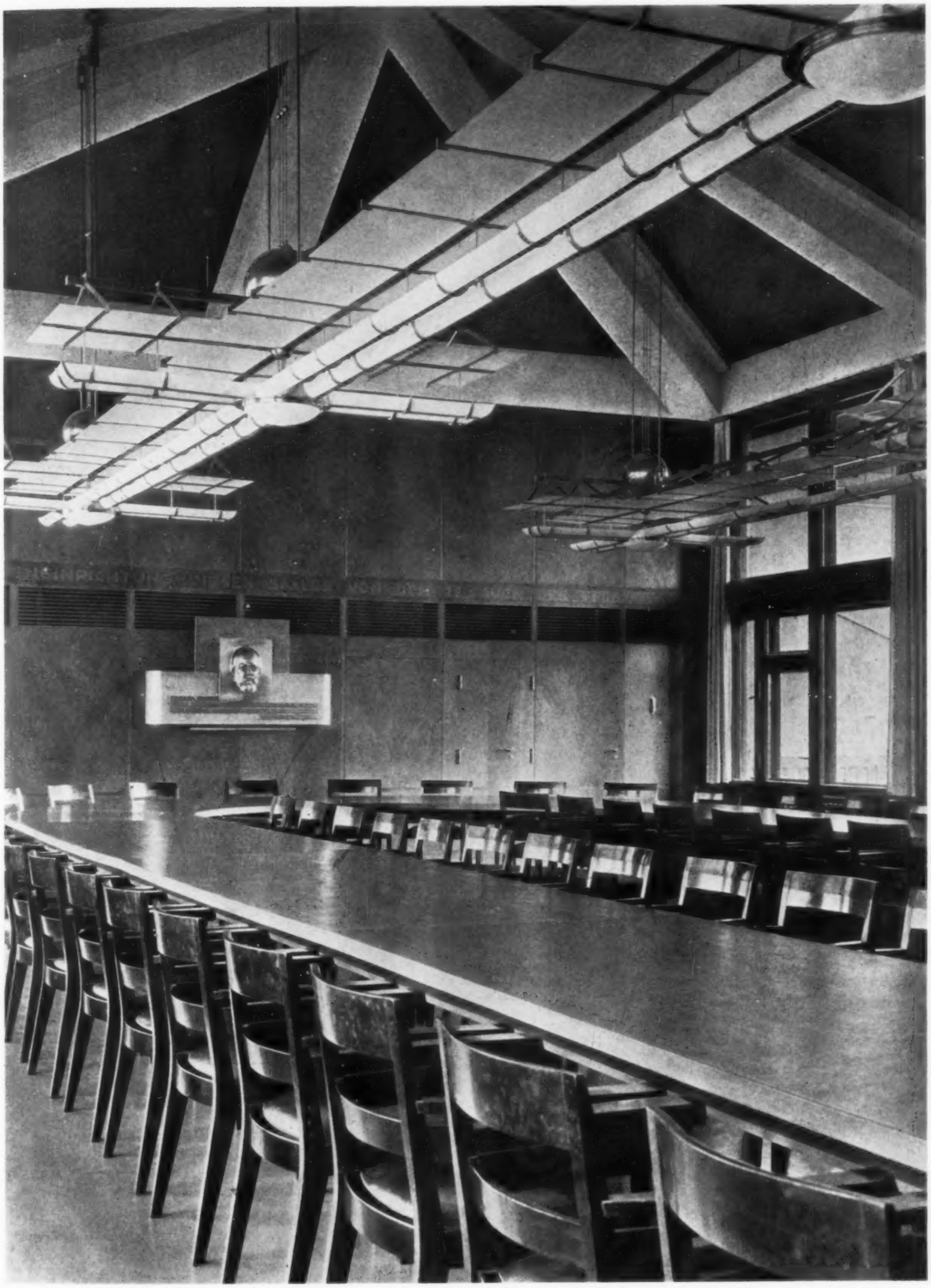


EXHIBITION PAVILION, STADTHALLE, MAGDEBURG
ALBIN MULLER, ARCHITECT

RUDOLF MOSSE BUILDING, BERLIN
ERIC MENDELSOHN, ARCHITECT

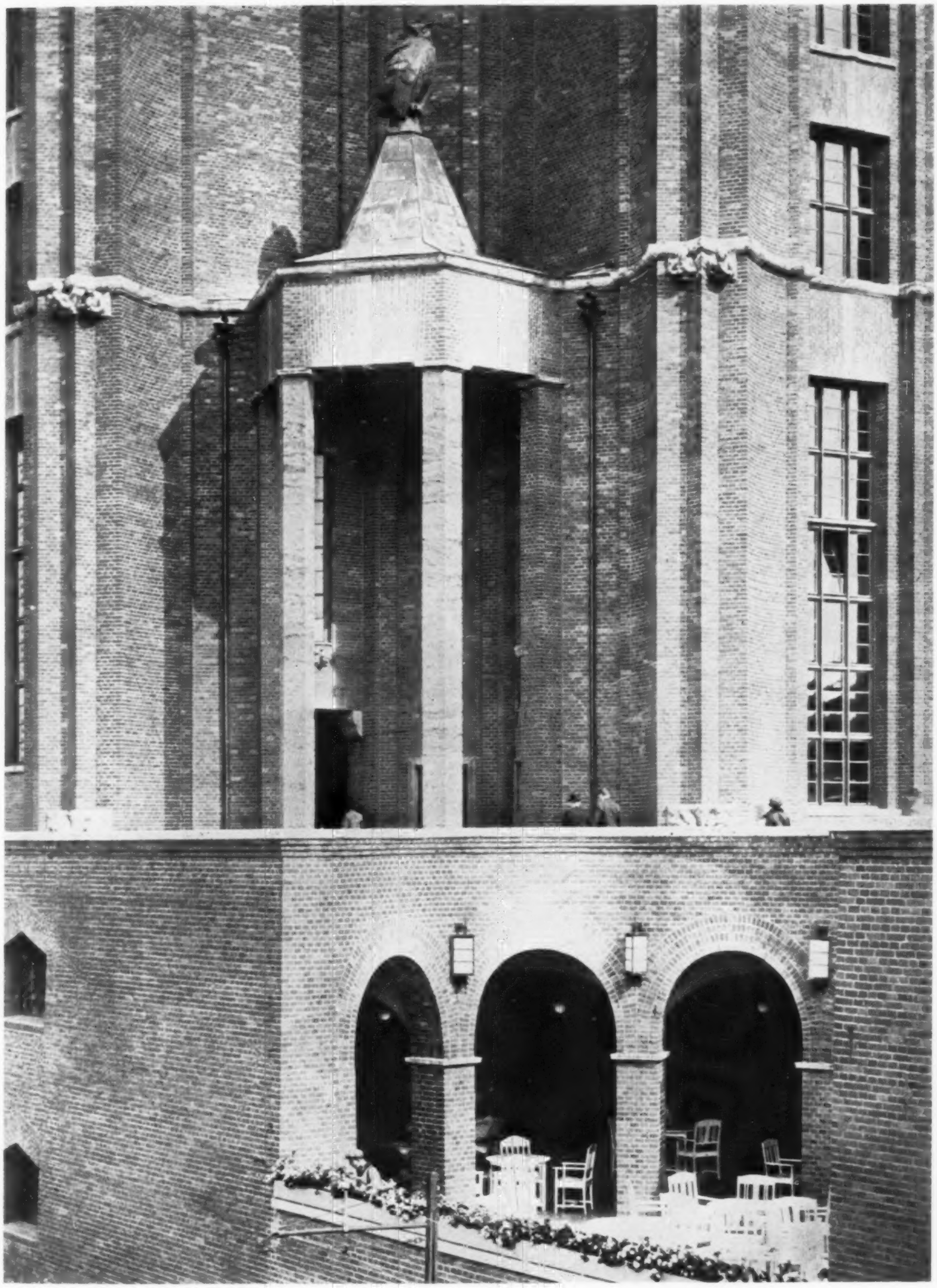
TITANIA MOTION PICTURE THEATER, BERLIN
SCHOFFLER, SCHONBACH & JACOBY, ARCHITECTS

AN INTERIOR. GERMAN BOOKPRINTERS' LABOR UNION BUILDING, BERLIN
MAX TAUT, ARCHITECT



BOARD ROOM, BOOKPRINTERS' LABOR UNION
MAX TAUT, ARCHITECT

ULLSTEIN DRUCKHAUS, BERLIN
E. G. SCHMOHL, ARCHITECT



DETAIL. ULLSTEIN DRUCKHAUS, BERLIN
E. G. SCHMOHL, ARCHITECT

MAIN STAIRWAY. ULLSTEIN DRUCKHAUS
E. G. SCHMOHL, ARCHITECT

WILLIAM HOOD DUNWOODY INDUSTRIAL INSTITUTE, MINNEAPOLIS

HEWITT & BROWN, ARCHITECTS

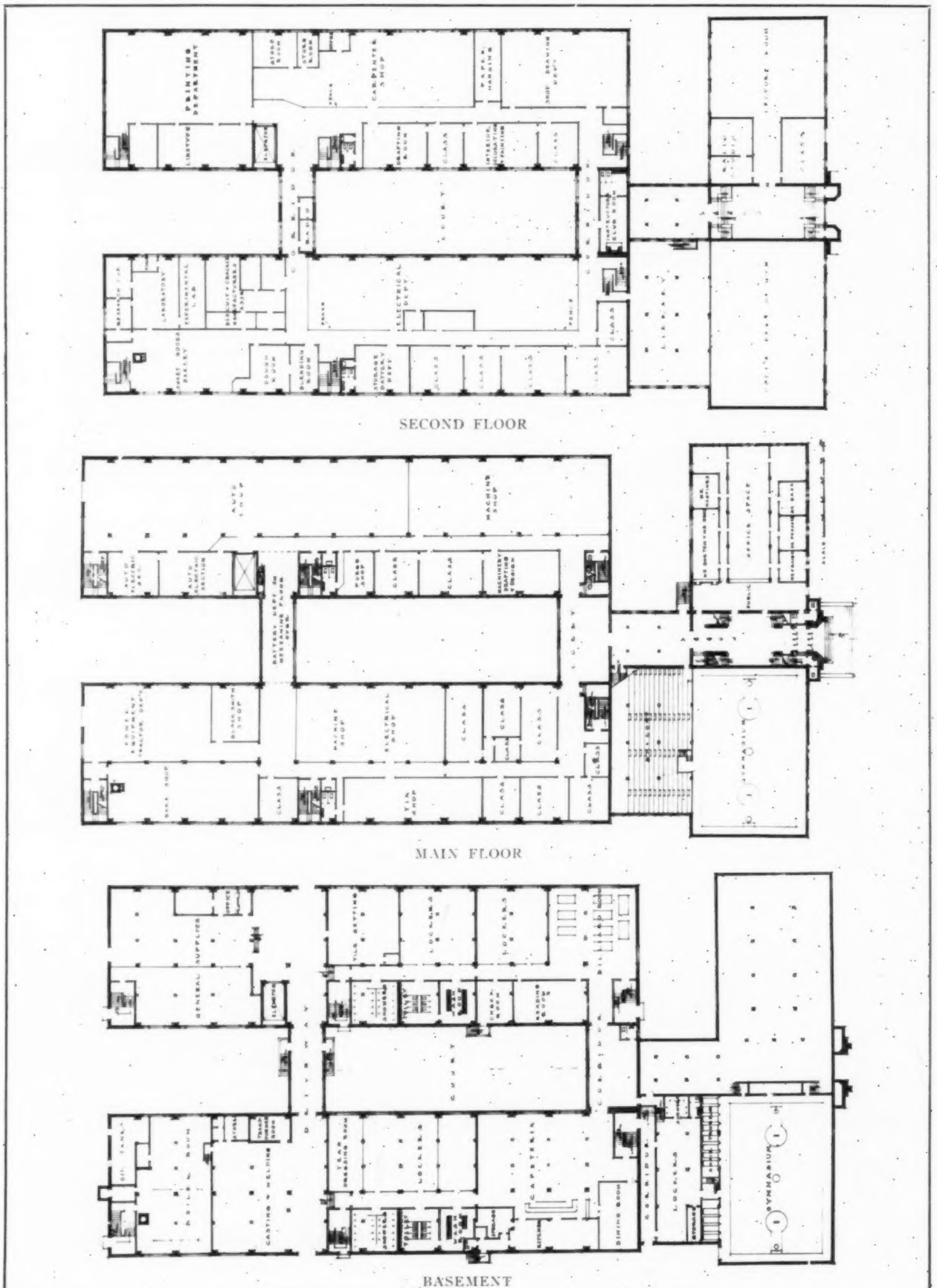
BY
C. A. PROSSER

WHEN William Hood Dunwoody, a leading business man of the northwest, died, in 1914, he left the greater portion of his large fortune to found a new industrial and trade school. Upon her death, which soon followed, his wife, Kate L. Dunwoody, created a separate trust for the benefit of the new educational institution that bore her husband's name. Those who have studied it, regard his will creating an educational foundation for the William Hood Dunwoody Industrial Institute as a model instrument, particularly in its provisions for the organization and support of the school. Mr. Dunwoody instituted a self-perpetuating board of trustees, composed entirely of leading business men of Minneapolis with whom he had been closely associated, and he placed in their hands, subject only to a very few conditions, the full power to develop the school as they saw fit and as changing conditions might require. While the Institute was to be located in Minneapolis, training was to be free to residents of Minnesota and given without "distinction on account of race, color or religion."

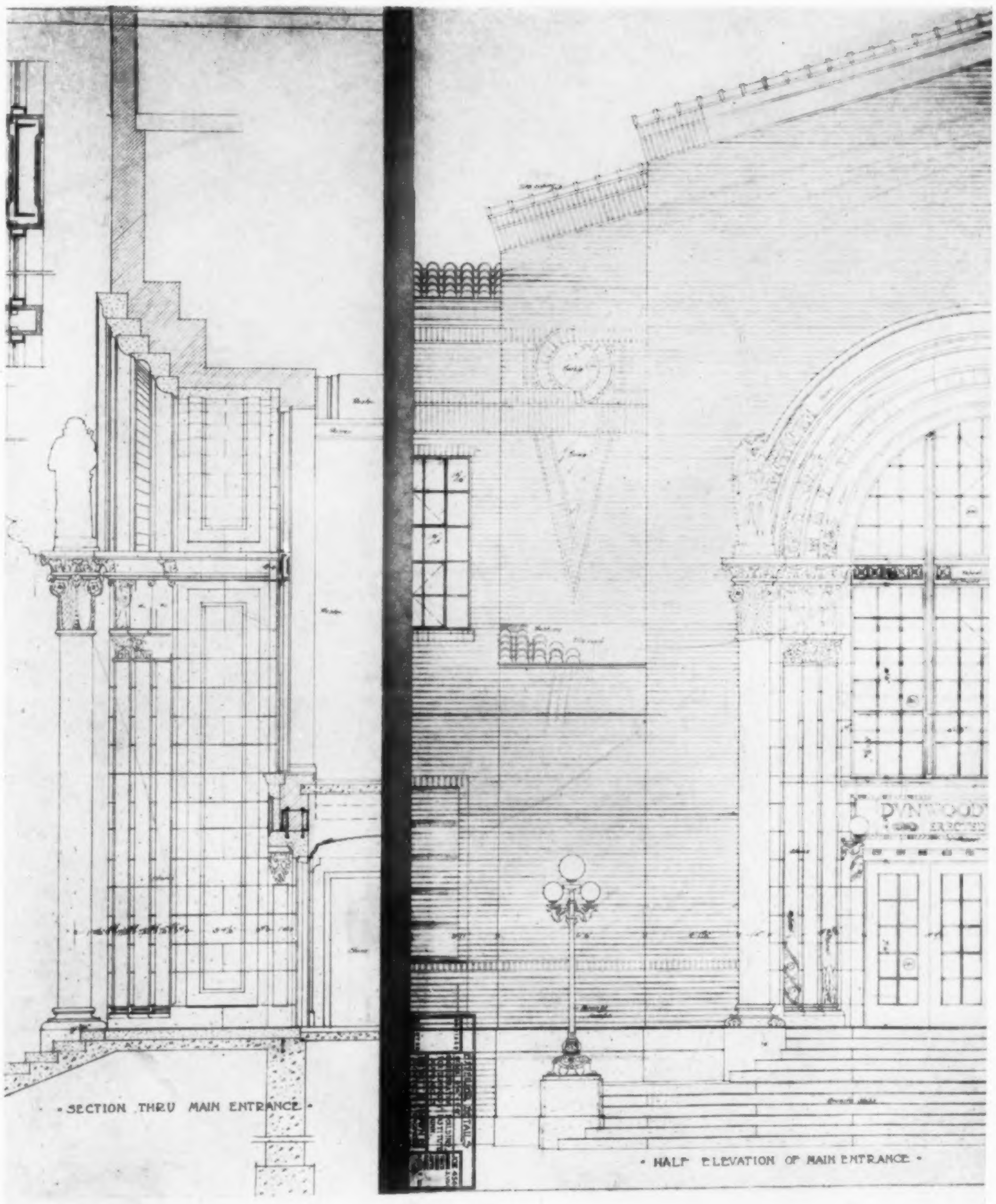
By an understanding with the Minneapolis Board of Education, the vocational training of girls and women for industrial occupations was taken over by the public schools. As a result, Dunwoody Institute has, from the start, confined its service to males. In the exercise of their discretionary powers, the trustees construed the language of the will so as to serve men as well as youths. For three years the school was housed, through the generous coöperation of the Minneapolis Board of Education, in an old high school building which had been abandoned for regular school purposes. During this period, a site was purchased and two of the three buildings now occupied by the Institute were built. Starting in 1914 with 40 students and provision for training in four occupations, the school now serves about 5,000 students annually and gives instruction through full-time, part-time and evening classes in some 65 different kinds of employment, chief among which are the occupations required

Photos. Hibbard Studio

William Hood Dunwoody Industrial Institute, Minneapolis
Hewitt & Brown, Architects

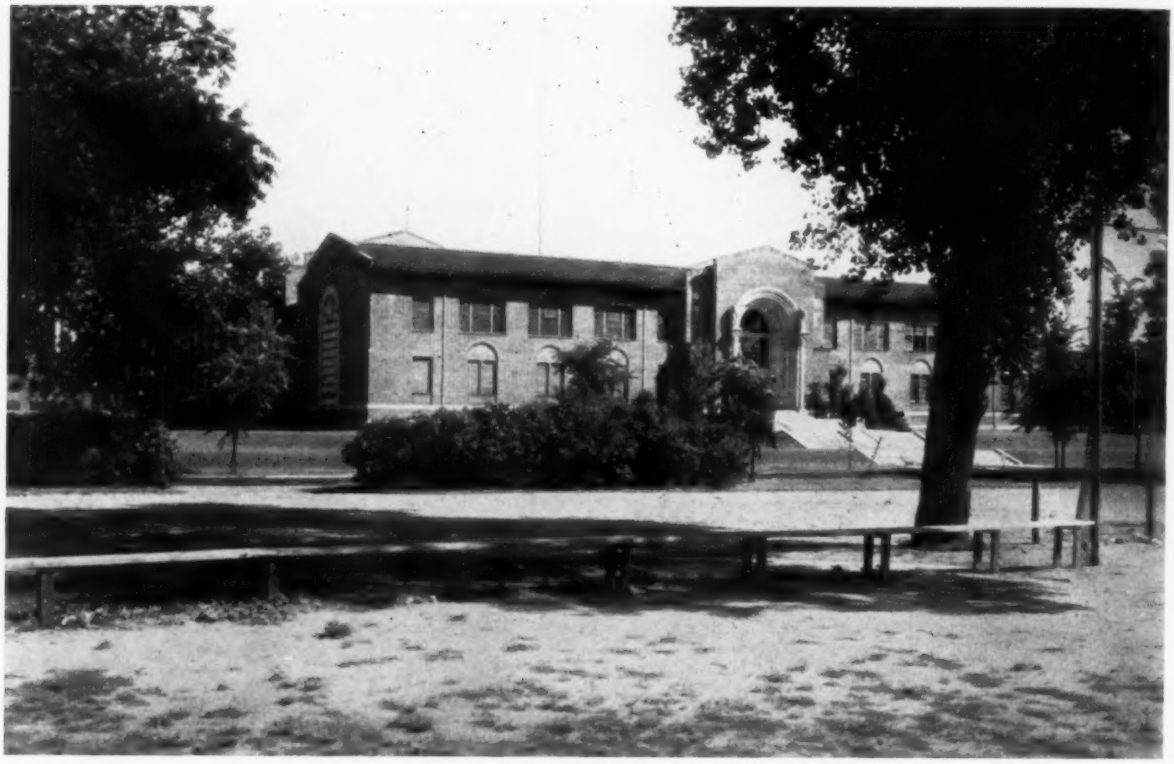


PLANS. WILLIAM HOOD DUNWOODY INDUSTRIAL INSTITUTE, MINNEAPOLIS
HEWITT & BROWN, ARCHITECTS



DETAILS. WILLIAM HOOD DUNWOODY INDUSTRIAL INSTITUTE, MINNEAPOLIS

HEWITT & BROWN, ARCHITECTS



GENERAL VIEW

FRONT ELEVATION

WILLIAM HOOD DUNWOODY INDUSTRIAL INSTITUTE, MINNEAPOLIS

HEWITT & BROWN, ARCHITECTS

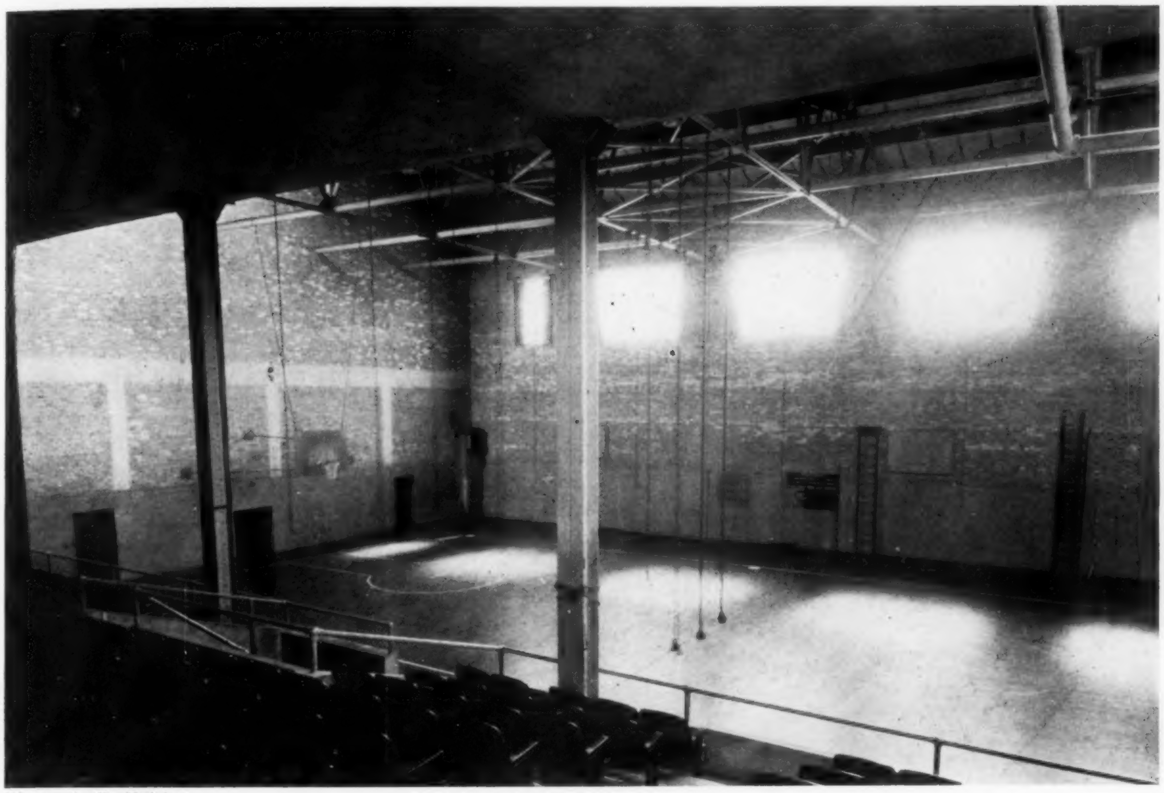


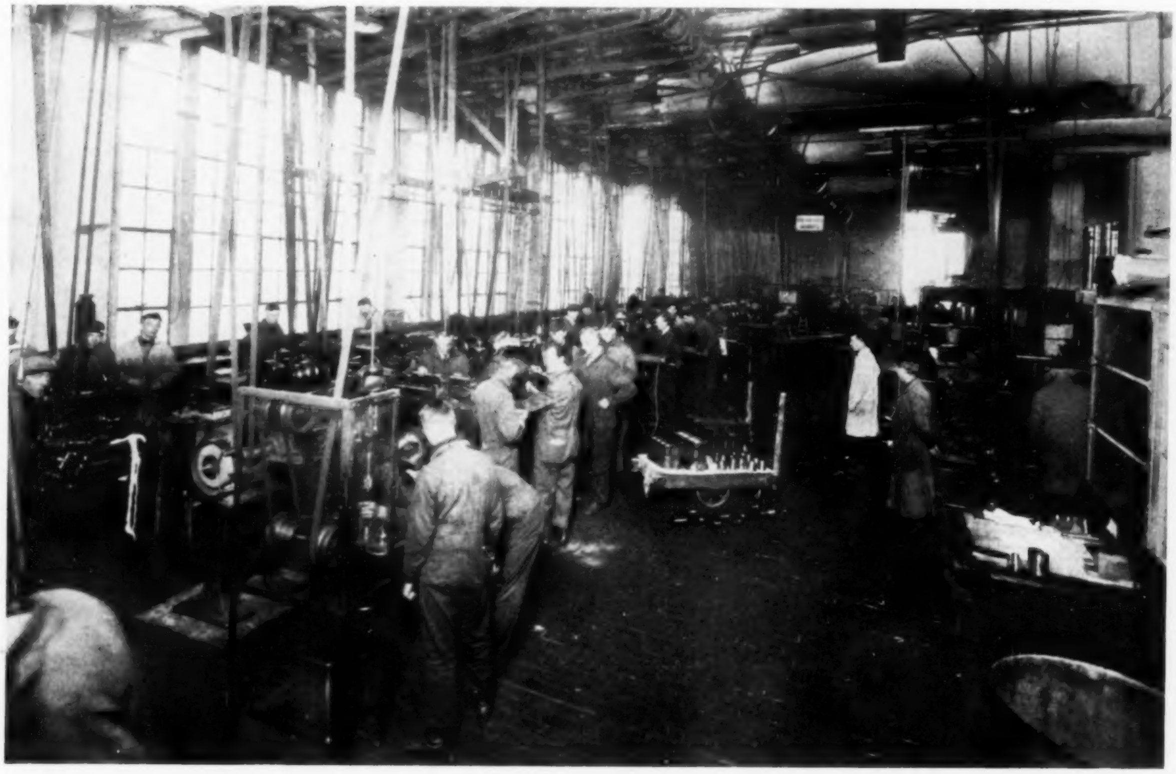
Photo. A. E. Kairies

Gymnasium. William Hood Dunwoody Industrial Institute, Minneapolis
Hewitt & Brown, Architects

in such lines as automobile repair and operation, baking, building construction, architectural and mechanical drafting, printing, electrical work, machine shop work, sheet metal working, highway construction, farm mechanics, tile laying, railway mechanics, operation of tractors, and the duties of foremanship. In the 14 years since it has been established, the school has enrolled more than 48,000 civilians in its various classes, most of which are conducted in its own buildings, but many of which have been held in the manufacturing plants of coöperating concerns in the Twin Cities. In addition to this, more than 7,000 enlisted men were trained during the World War for special occupations in the army and the navy, making a total of more than 55,000 persons who have thus far been reached and helped by Mr. Dunwoody's benefaction. While the great bulk of this registration came from residents of Minnesota to whom tuition is free, an increasing number of non-resident students, who pay the actual cost of instruction, come from all parts of the United States and from many foreign countries to the schools which the Institute operates in the three lines of baking, printing and tile laying. So rapid has been the growth of the student body that the Institute reached five years ago the maximum attendance which the income from the endowment could be expected to provide for.

Shortly after the site was purchased, the trustees selected the firm of Hewitt & Brown as architects, and a year was spent by these architects, working in close contact with the officials of the Institute, in the development of plans for the buildings. In the purchase of the site, certain considerations were carefully safeguarded. Since the Institute was to be virtually the one center of industrial education for the community, it must be easy of access from every section. Accordingly selection was made of ground in the heart of the city, less than ten blocks from the loop district, less than three blocks from the main traveled car line, and facing a main traveled boulevard which separates it from the city's largest recreation park. Since ample space for known needs and for possible expansion must be provided, six plotted but unoccupied city blocks were purchased, the intersecting streets and alleys being closed by city ordinance and added to the tract. While this tract serves most admirably the purpose of the school, its nature was such as to make it poorly adapted for most uses; hence it was acquired at a low figure. Because the site was in some earlier period an old bed of the Mississippi River, a subterranean stream still flowing through, construction required considerable piling, the additional cost of which was more than offset by the advantages of the location and the unexpectedly small cost of the ground thus rendered available.

During this period, the architects and the di-



MACHINE SHOP

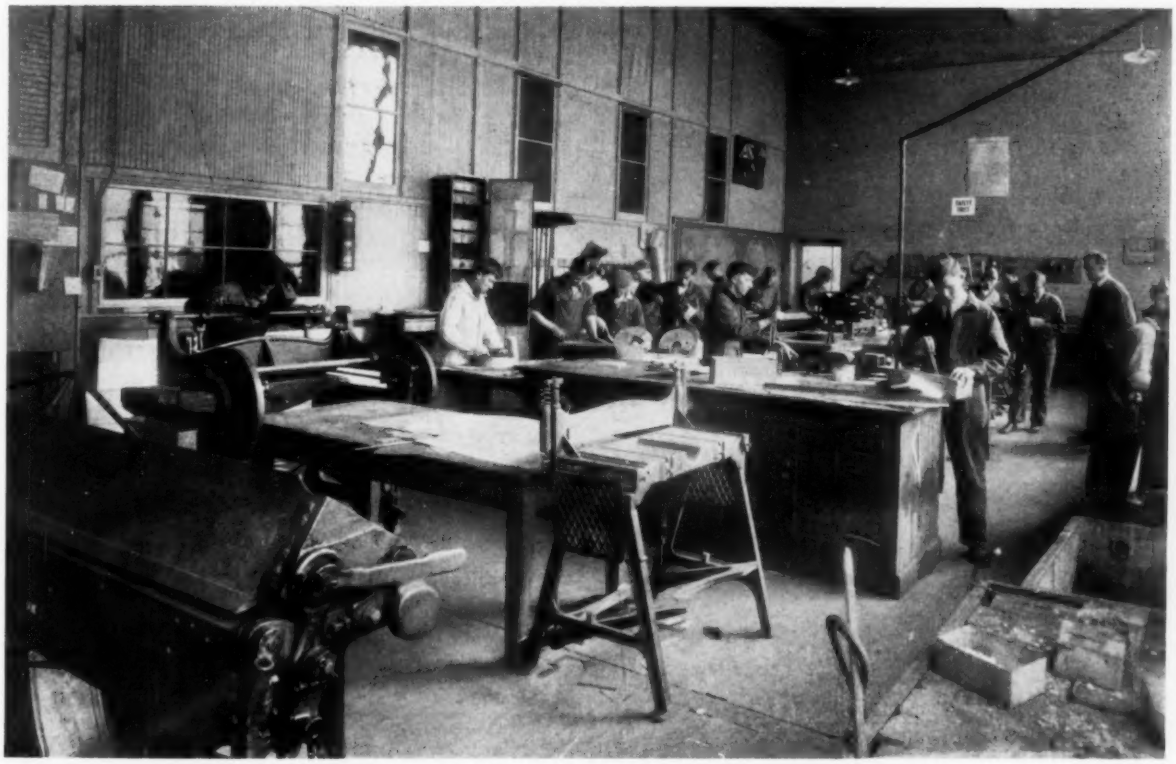
Photos. Hibbard Studio

PRINTING DEPARTMENT

WILLIAM HOOD DUNWOODY INDUSTRIAL INSTITUTE, MINNEAPOLIS

HEWITT & BROWN, ARCHITECTS

AUTO ELECTRIC SHOP



SHEET METAL SHOP

WILLIAM HOOD DUNWOODY INDUSTRIAL INSTITUTE, MINNEAPOLIS

HEWITT & BROWN, ARCHITECTS

Tile Setting Department. William Hood Dunwoody Industrial Institute, Minneapolis
Hewitt & Brown, Architects

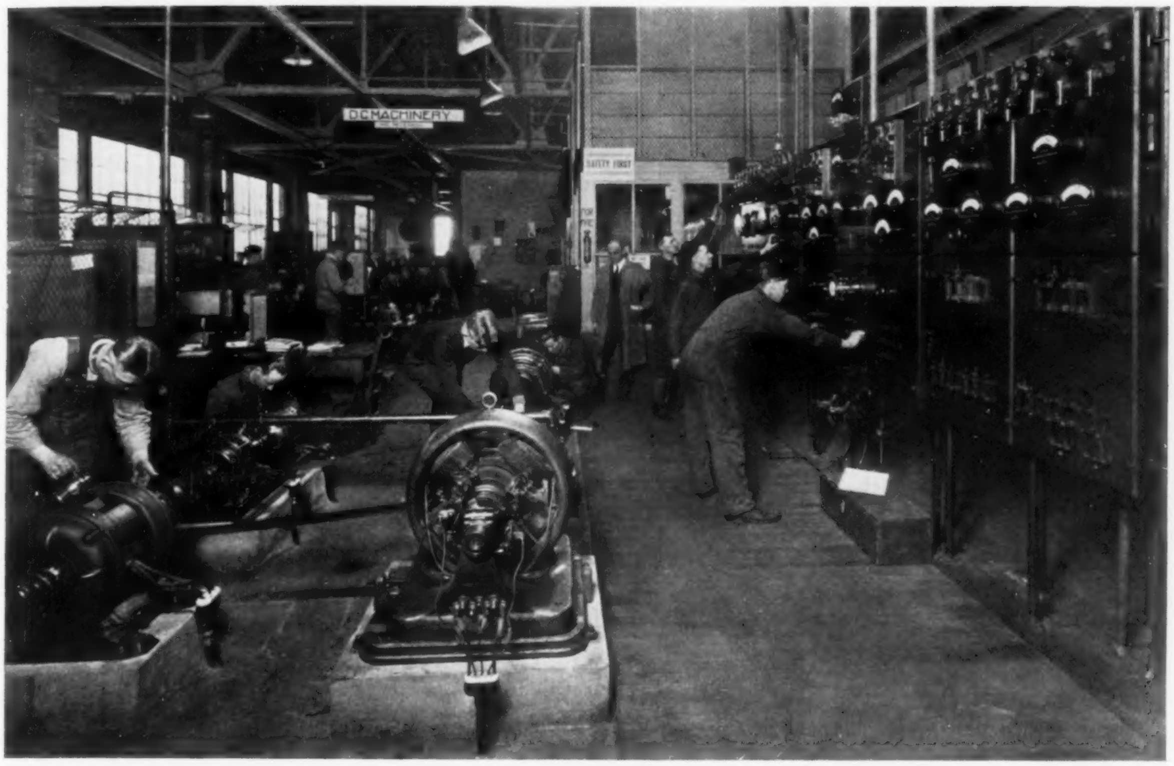
rector and assistant director of the school visited virtually all of the larger of the industrial and trade schools which at that time had been established in this country, as well as the shops of a number of engineering and technical schools. From this visit a number of valuable ideas were gained, but they were confirmed in their belief that the plant for the Institute could not be modeled after that of any existing institution. Rather must it be adapted to the ideas of the authorities of the school regarding the kind of training which should be provided and the conditions under which the work must be done. Before any plan could be sketched it was necessary that the Dunwoody authorities should arrive at a meeting of minds regarding certain matters. In this they were helped to some extent by an industrial educational survey for Minneapolis which had been made in 1915 by the National Society for the Promotion of Industrial Education in coöperation with the Minneapolis Board of Education and the trustees of Dunwoody Institute. On the findings and recommendations of this survey the first work of the school was based. To this help should be added the experience gained in working with the problems while the school was housed in temporary quarters. Constantly the remarkable group of business men who composed the board of trustees brought to bear their ripened business experience. They had a deep interest in the task, were determined to make the school and keep the school true to the declared aims of its founder, and were soon "sold" on the ideas of national leaders as to what constituted real industrial training, which have since gained such widespread acceptance.

From all these conditions, there resulted certain very clear cut decisions on the basis of which the plans and specifications were drawn:

1. Although only two units were to be constructed, a comprehensive layout must be made which would fit them into the complete plan.

2. As the core of instruction in industrial education is the shop work where practice is given in the use of knowledge to get things done, these two building units should be primarily shop units, leaving to the future the problem of constructing a separate building for administrative offices and additional classrooms and other facilities. Seven years later this step was taken, but only after the growth of the school made it necessary. The trustees were then in a position to profit by experience and were provided with funds acquired by careful savings in their reserves to aid in financing the new construction.

3. Since industrial habits are best formed by actual practice on the kinds of problems on which the learner must use them in occupation, and in the kind of environment in which he is to use them for wage earning, these shops must in every



Electric Department. William Hood Dunwoody Industrial Institute, Minneapolis
Hewitt & Brown, Architects

respect be made as nearly like those of commercial plants as they can be made under a school roof. Accordingly these two buildling units are entirely of factory construction. On the day they were completed they consisted virtually of two substantial shells, each having a 9-foot basement and two stories, the floors being 285 feet long and 75 feet wide, with a height in the clear of 18 feet between beams and floor and lighted by large and almost continuous windows. On the interior they are precisely the kind of modern factory buildings to be found in any prosperous industrial district, and indeed they could readily be sold today and used for actual manufacturing purposes.

4. Since the effective training of anyone in doing anything requires a close tie-up between practice and theory, between knowledge and the use of that knowledge to get something done, the classroom work of the school should teach mathematics, drawing, science and trade practice as applied to the trade. In order to do this properly these classes should be held either in the shop itself or in rooms close by. Because each trade has its own body of facts and ideas which pertain specially to that trade, each trade taught by the Institute should be a unit designed to serve those engaged in learning something about some occupation in that trade. Accordingly, the building units are so constructed as to give each trade a distinct home where all the forms of shop and class work bearing on that trade are centered. By the simple policy of erecting movable partitions instead of immovable walls, there were set up within the space classrooms for each trade, opposite the shop floor, and these partitions have been shifted many times to meet changing conditions.

5. Since the instruction was to be practical fitting for bread winning, such buildings should be simple and not ornate, and should be kept so. Construction should be substantial and meet every demand for use. Equipment should be such as would give real trade experience and should not be allowed to become obsolete. On these two requirements emphasis must be laid in the expenditure of the funds of such an institution. The resources of any endowment must be husbanded because of the application to them of the adage "you cannot eat your cake and then have it." Not only did considerations of rational economy forbid elaboration in these buildings, for it was due to considering the eternal fitness of things as well. Training mechanics to work in marble halls violates reason and good taste. All these buildings, as a result, show from the exterior precisely what they are. They are places of service to those who desire to fit themselves for doing the kinds of things they must do all the days of their lives. Careful attention has been given to perspective and balance. Straight lines are employed instead of curves. Inexpensive but carefully kept lawns

and shrubbery give an attractive setting. On the interior, plain tables and stout chairs take the place of the traditional school room equipment, while the shops are but little more furnished than those of an enterprising commercial concern. Only the entrance to the new administration building provides anything in the nature of what might be called special decoration. There an attractive arch suggests by symbolic figures the principal trades which the school serves, and suggests the necessity that the successful mechanic should combine in his work both knowledge and skill. Any passer-by can see at a glance that here is a shop which is not all shop,—a school which is not all school in the ordinary sense of that word.

6. If the school is to be efficient and is to realize its full possibilities, it must be free to deal with its problems as they arise. Among other considerations, it must not be hampered by physical conditions. The plant, to illustrate, must be of ready access from main traveled thoroughfares and yet be so set within the grounds as to be protected on every side from outside noise, and from interference with light and air from any source. Not only must the grounds be extensive enough for these ends but they must also provide for the future expansion of the Institute as well as afford facilities for athletics, for adequate parking areas to accommodate the maximum number of cars used by instructors and by students, particularly by evening school men. And a spur track through the grounds to oil tank and stock room must facilitate shipments and reduce the cost of the extensive supplies which a school must use when it operates productive shops in order to insure actual trade training.

7. Without doubt, the greatest attention was paid to the need for flexibility. Industrial conditions change frequently, and if the Institute is to meet the real needs of workmen, it must be free constantly to adapt and re-adapt itself to the changing situation. New trades and occupations are continually arising and older trades disappearing, while others are being profoundly modified in their processes. The plant of the school must therefore facilitate and not hamper the effort to adjust itself continually to demands.

It will be impossible to point out here more than a few illustrations of the extent to which this necessity was safeguarded. By making the load-carrying power between beams practically the same at all points on all floors, it is possible to provide for use of almost any kind of equipment at any place, thus making all parts of the building equally available for any kind of training and making it possible to shift any trade to new quarters when conditions require. By installing at the time the building was erected and at regular intervals of about 20 feet facilities for using gas, electricity, water, compressed air and drainage, these services are ready to be tapped and used at convenient points for every conceivable kind of training the Institute might see fit to undertake.

8. By placing at accurate intervals in all cement ceilings stout rings which are readily uncovered and easily utilized, it is no trouble to hang overhead shafting in new places and to supply for any purpose overhead support for anything desired. Attention has already been called to the use of movable partitions. Separated from one another down the long stretch of open floor only by wire fencing easily moved, the shops of the various trades can readily be collapsed or expanded according to the demands which the enrollment makes upon them, and so readily that this is often done on Saturdays so as to present on Monday morning quite a different allocation of floor space.

Many of the features described here contributed to the comparatively low cost at which the plant was constructed. For the shop units erected in 1916-17, this cost was roughly 19 cents per cubic foot when the cost of construction for similar purposes by other institutions with which the writer is familiar ranged during the same period around 27 cents. This statement is not made in any boasting spirit. Mistakes have been made, and doubtless there are others of which those in charge should be aware. Taken as a whole, however, these are of comparatively small importance contrasted with advantages which have been gained.

From the standpoint of the school man, there are certain convictions which may be worth expressing in closing,—convictions at which the writer has arrived regarding sound procedures to be followed in the construction of any building for any educational purpose, particularly if it be some special purpose such as industrial or trade education. Among these convictions, to mention a few:

1. The responsible school authorities should first arrive at a meeting of minds concerning the kind of service they desire to render in the proposed building.

2. All the helpful experience of others should be collected and brought to bear in planning the service to be performed and the building in which it is to be rendered.

3. The building should be looked upon simply as a device,—a tool to be used in rendering this service efficiently.

4. Every feature of the structure should be planned from the standpoint of the purpose for which the building is to be used.

5. There should be recognition of the changing conditions to which the service must constantly be adapted.

6. Since these changes cannot be forecasted or anticipated, the building should be originally constructed to give the greatest possible flexibility.

MODERN FURNITURE AND DECORATION

DESIGNED BY HERBERT LIPPMANN, ARCHITECT

BY PARKER MORSE HOOPER

FOR three months during the late winter and early spring of this year record crowds visited the First Exhibition of Contemporary American Industrial Art at the Metropolitan Museum. From the point of view of design, the outstanding fact about this exhibition was that all of the several rooms were conceived and designed by and executed under the supervision of several of the leading younger architects who are particularly interested in modern design. Had the space devoted to this exhibition at the Metroplitan Museum been greater, there is no doubt but that Herbert Lippmann, another one of the younger architects interested in modern design, would have been represented.

THE ARCHITECTURAL FORUM considers it a privilege to publish the accompanying illustrations which clearly show Mr. Lippmann's ability in designing and arranging modern furniture in an attractive and homelike manner. It has often been said that the rather angular and sometimes austere character of modern furniture does not adapt itself well to domestic interiors. After studying these illustrations of modern furniture and decorations by Mr. Lippmann, it is possible to appreciate the fact that contemporary furniture, if designed with a thought for comfort and convenience as well as simplicity and style, can be successfully used in American homes. Just as the modern style of architectural decoration seems particularly fitting for shops, stores, clubs, restaurants, theaters and hotels,—in other words, for many types of places used by or pertaining to the public,—so also it may be successfully used in city homes, either apartments or houses. The rather severe and formal character of most modern furniture makes it perhaps more appropriate and suitable for urban than for country homes.

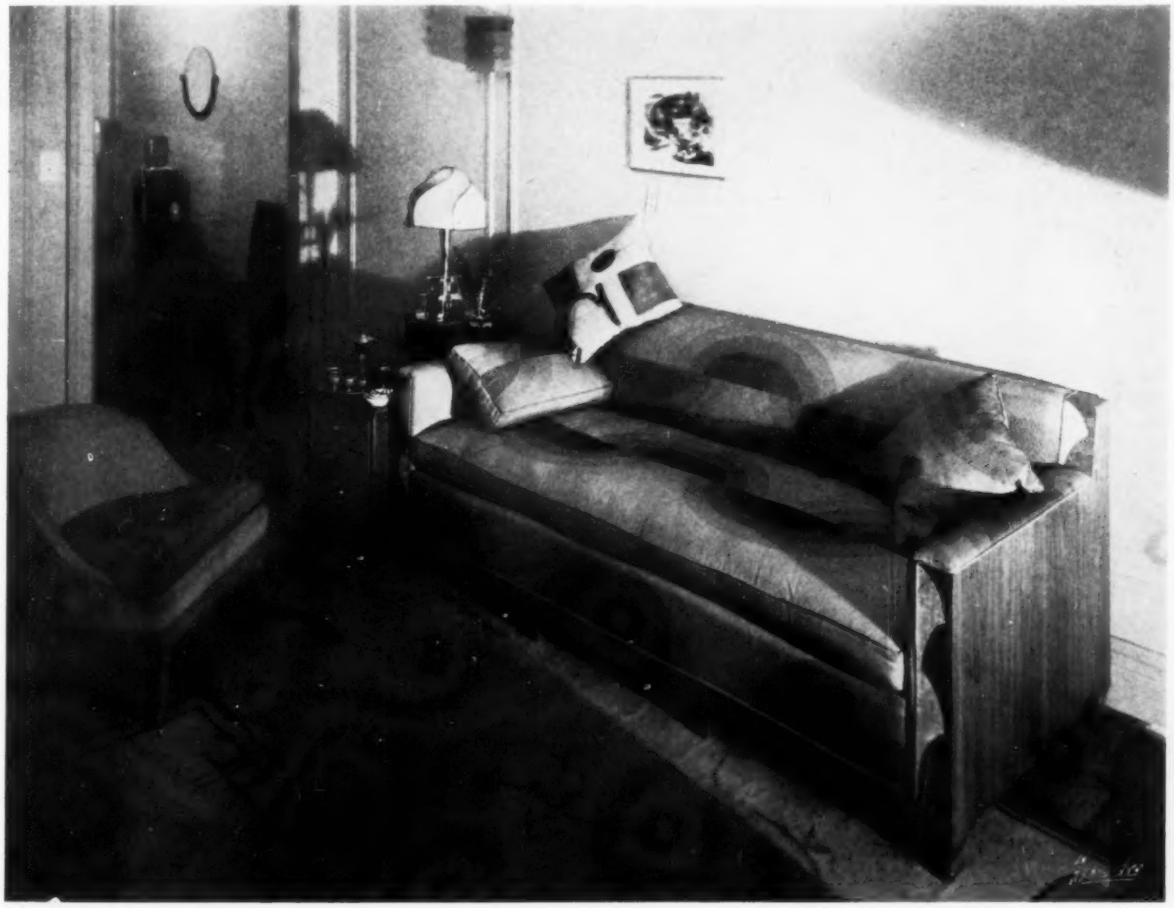


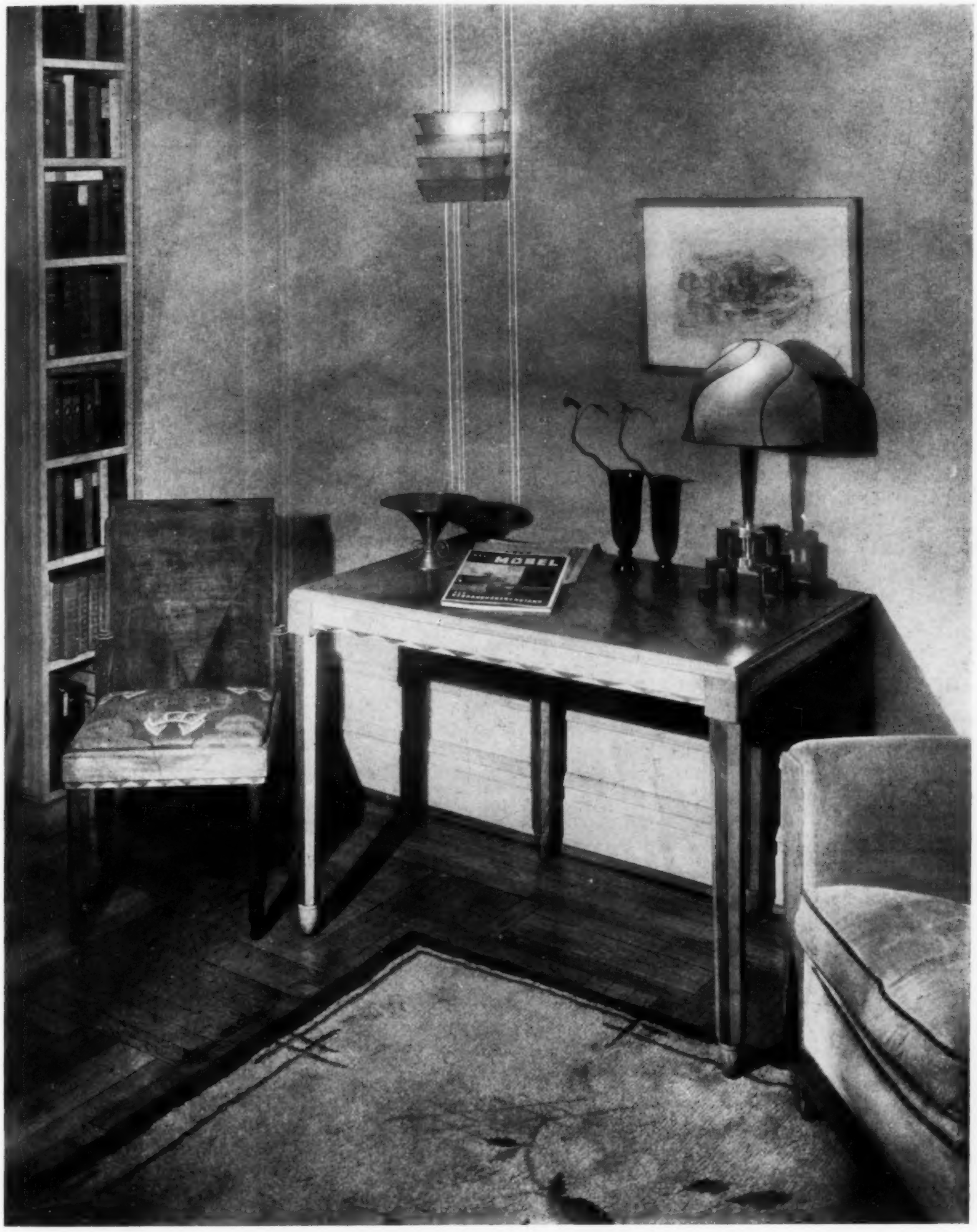
Photo. Apeda

This comfortable couch, designed on simple lines in the modern style, has sides of American walnut and patterned woodwork of old Japanese maple and dark Thuya veneers, and upholstery in a Rodier fabric, "Disc," of silver grays and greens. The side table has satinwood veneered drawer fronts, amaranth case, legs and book holders, silver sycamore trim moulding, and dull steel hardware. The other furniture is elsewhere described

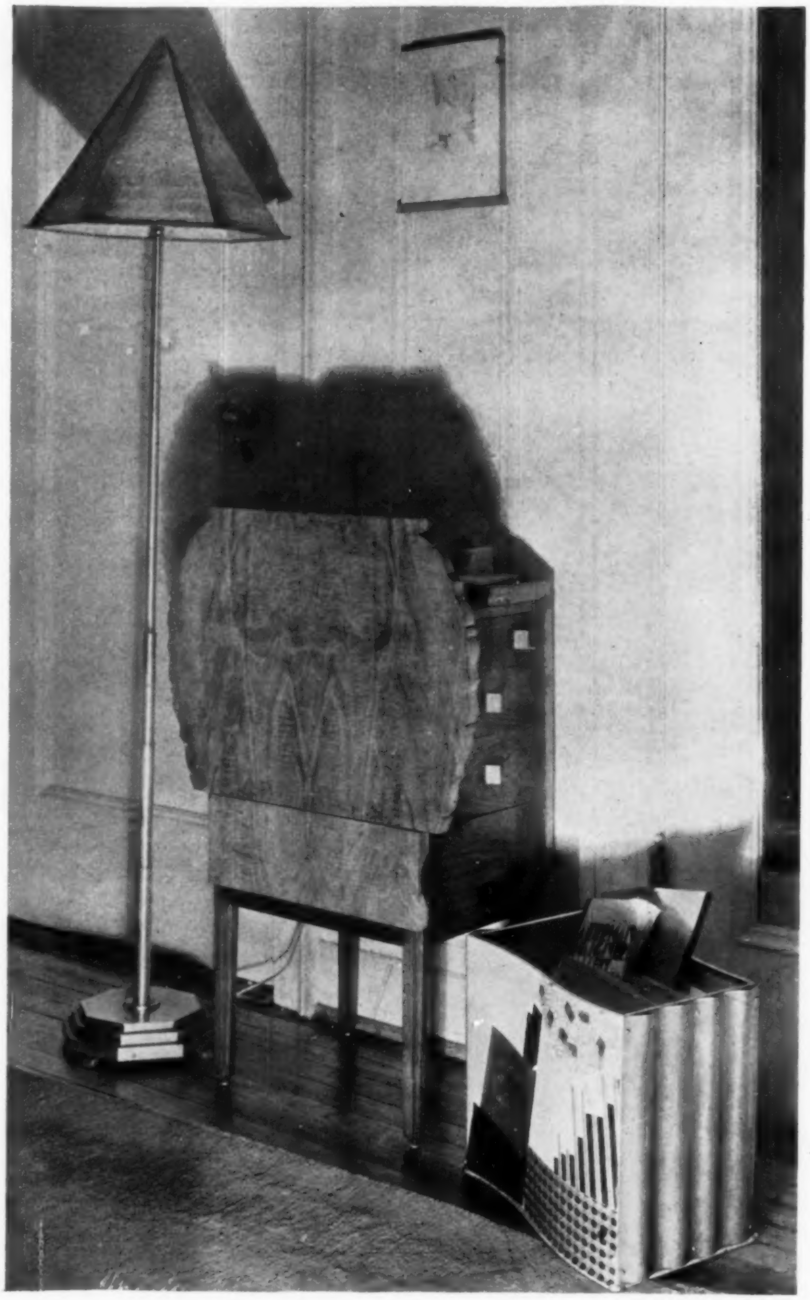
The writing desk chair has a semi-hexagonal back of amaranth veneer. The seat cover is a Mercier damask designed by Dufy. The writing desk has solid American walnut legs and sides, including the drawer fronts, with French walnut back and top and veneered front. The desk is of the tip-table variety with drawers of standard typewriter paper size. This piece was designed to fit the smallest possible space and yet serve its purpose as a writing desk which will safely support a portable typewriter. The standing chest seen at the right of the illustration has drawer fronts veneered with satinwood, the case veneered with amaranth, ornamental fluting and trim mouldings of silver sycamore, and hardware of dull steel. This piece was designed to fit the corner where it stands, but is paneled on the hidden sides so that it may be used in any location

The drawers and door fronts of this dressing table are veneered with satinwood. The case itself is veneered with amaranth, with ornamental fluting and trim mouldings of silver sycamore and bands of dull steel. The triangular tray is of plate glass with mirror pattern and German silver edge moulding. The lamps are of Lalique glass with shades of silk. The small chair has a solid French walnut frame, back and legs, with amaranth strips veneered alternately on the legs and a triangular ornament of amaranth and satinwood around the frame. The seat is upholstered in a Mercier damask designed by Dufy. This chair is one of a set of six which can be used for a dining table suite. The upholstered chair is a stock design by Hammond Kroll; the frame and legs are of natural birch, and upholstery is Rowena fabric; the seat in henna and the rest in scarlet

This box chair is an unusual piece of American walnut veneer with the effect of a forest or group of skyscrapers in profile portrayed by the heart wood with lighter cloud effects in the annual rings of the sap wood. The upholstery is of apricot silk velvet. The waste basket is papered in blue, yellow and green. The iron coffee table with black and clear glass shelves was designed by Jules Buoy. The shade on the lamp is of blue tracing linen with silver brocade borders.



Here is a table of French walnut, the top veneered with amaranth and steps veneered with satinwood. The legs are alternately veneered with amaranth, and the triangular ornament on the apron of the table is of alternate veneers of satinwood and amaranth. This is a convenient living room and dining room table. It has a drop leaf at the back, which may be supported on slides so that it can be used as a dining table for four people. In the dining alcove is a small table for the use of two people, so designed with a drop leaf that it may be joined to this table for the use of as many as eight people. The rear legs have been set back from the side edges so that two or more people can be comfortably seated on the sides when the two tables are joined together. The side chair with arms, which is of amaranth veneer, may be used as a dining room chair when occasion requires. This is the third type of chair shown in these illustrations, chairs which, when grouped together, make a set of six for dining purposes



This small writing desk has already been described on page 92. It is here shown with the drop leaf raised. The steel-finished lamp has a parchment shade in green and yellow

BOOK DEPARTMENT

THE IDEALS OF ENGINEERING ARCHITECTURE

A REVIEW BY

CLIFFORD WAYNE SPENCER

THE importance of engineering to architecture is something easily appreciated by all, and the necessity for good engineering in buildings has never been so great as in the present era, with its towering structures based entirely on engineering formulæ and principles. This necessity is duly appreciated by the architectural profession, and no architect would dream of attempting to design an important building without the aid of good construction engineers. On the other hand, the importance of architecture to engineering has too often been disregarded, and the country is full of structures whose engineering character has led their designers to feel that any adornment or artistic treatment was unnecessary, so that the resulting structures, by their barrenness or bad arrangement of parts, give a depressing effect of extreme ugliness. The designing of great engineering structures is often entrusted to men trained to figure accurately and to build with great mathematical precision but with little or no understanding of the fundamentals of artistic arrangement and adornment. As the training of architects errs perhaps on the side of too much study of archaic forms and ancient beauty, so the curriculum of the engineering student has contained too little consideration for the æsthetic possibilities of structural forms. More care and consideration for the appearance of engineering works would undoubtedly lead to a greatly improved type of engineering without making it necessary to sacrifice any of the utilitarian or economic advantages so important from a practical point of view. Often the things which go to make or mar the beauty of a structure seem surprisingly trivial. A well designed set of finials may save from ugliness the most ungainly of bridges without the use of any other decorative feature whatever. More often the structure can be given a curving or sweeping motion or rhythm that will add immeasurably to its æsthetic quality without impairing its strength in the least. Therefore, the attention of the architect is needed.

Part of Dam at Croton, N. Y.
From "The Ideals of Engineering Architecture"

New discoveries in engineering science have added greatly to the resources at the command of the engineering designer and doubtless will continue to do so. New materials and new ways of using old materials also are opening up vast new possibilities in the field of engineering as well as in that of architectural design. The comparatively modern use of steel and concrete, both independently and in combination as ferro-concrete, has put into the hands of the designer a medium of vast possibilities which at the same time provides unprecedented structural advantages. In the use of these materials engineering plays a far more important part than ever before, the materials and new scientific processes making possible a much lighter type of construction than was ever possible in the old masonry and wooden structures, and at the same time permitting buildings to be carried to almost unlimited heights. These new possibilities make it more desirable than ever that more attention be paid to the artistic planning of engineering works. If an engineer is to plan the whole, he should be sufficiently grounded in the basic principles of art and architecture to enable him to work out his designs in the most pleasing manner possible. On the other hand, if a special consultant is to be employed to beautify the structure, he should strive to understand the underlying principles and purposes of the work, for in no other way will he be able to achieve that harmonious and satisfying effect which should result.

For nearly two decades Charles Evan Fowler has been working to "develop a trend of thought, along somewhat systematic lines, tending toward a real system for the treatment of engineering structures by means of basic architectural design." His book on this subject has recently been published and is entitled "The Ideals of Engineering Architecture." Mr. Fowler is an eminent consulting civil engineer, the designer of many important structures, and author of many works on engineering and architectural subjects. The volume itself is perhaps the most extensive work on the subject of engineering architecture yet produced and covers the subject in a

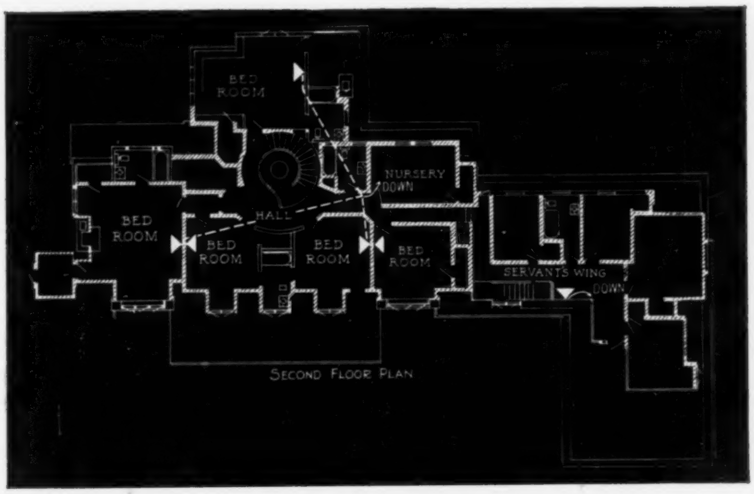
Unless otherwise noted, books reviewed or advertised in THE FORUM will be supplied at published prices. A remittance must accompany each order. Books so ordered are not returnable.

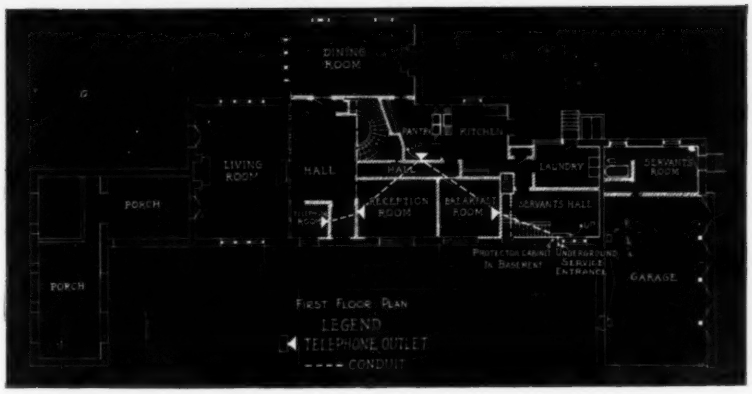
most complete and thoroughgoing manner. Most of the text matter is in the form of descriptions and criticism of a large number and variety of engineering structures in all parts of the world, with special reference to the design features of the examples shown. These discussions are abundantly illustrated from photographs of the structures themselves, showing features favorable or unfavorable to the appearance as pointed out by the author in the text descriptions. The ideas and aims of the art of engineering architecture and the part played by the structural engineer in the new architecture are discussed at some length in the introduction, and there is also a brief historical sketch of engineering architecture including a description of the seven wonders of the ancient world. A very clear statement of the fundamental considerations governing a good engineering and a good architectural design is given, and a comparison drawn between them, the prerequisites of good architectural design being sincerity, propriety, style, and scale. As a matter of fact, the fundamentals are probably much the same in both cases, and the symmetry, harmony, simplicity and proportion ascribed by the author to good engineering design are but other words to define the sincerity, propriety, style and scale said to be necessary to successful architectural design. The major portion of the work is devoted to bridge design, this being the class of structure which is most likely to be entrusted to the engineering profession. Stone bridges are among the oldest in the world, and their design is the result of tradition developed through the ages, the most usual form being that of the arch. Many fine examples are shown, and the lessons drawn from the criticisms by the author will be found valuable in other lines. Concrete bridges are a more modern development and lend themselves readily to architectural treatment, as is very evident from the examples discussed in the chapter on "Concrete Bridge Design." Steel bridges are by far the most important, commercially, in this country and have furnished some of the worst as well as the best examples of bridge architecture. Many types and varieties are described and illustrated, including among others, the Forth Bridge, Scotland; the Queensboro, Hell Gate, and Brooklyn Bridges, in New York, and many other existing and proposed spans. The treatment of details, abutments and piers and the application of ornament to all sorts of engineering work are discussed, and the chapters on "Stone Towers," including lighthouses, steel towers, mooring masts for dirigibles, dams and power houses are all interesting from the architectural point of view and important from that of engineering.

In the modern era it has more than ever before come to be necessary for the architect to understand the engineering point of view, and since the great variety of subjects which form the basis of architectural education will not permit the student to go into the more technical phases of engineering to any great extent, it is very fortunate that we have available a work written by one who sees problems as the engineer sees them and is yet keenly alive to the artistic possibilities latent in every structure. The work abounds in matter of value to both architects and engineers and deserves wide circulation.

THE IDEALS OF ENGINEERING ARCHITECTURE. By Charles Evan Fowler. 303 pp., 6 x 9 ins. Illustrated. Price $4. Gillette Publishing Company, 221 East 20th Street, Chicago.

Telephone Convenience is an Important Feature in the Planning of Modern Residences





The new residence of Mr. Thomas B. Wanamaker, in the suburbs of Philadelphia, showing the telephone outlets and conduit layout which provide for modern telephone convenience.—McIlvain & Roberts, Architects.

Increasing attention is being given by architects, in the design of modern residences, to the location of telephones. It is becoming generally recognized that the time to plan for telephone arrangements is when a house is being built or remodeled. In co-operation with telephone company representatives, architects are including provision for telephones in the plans of the house by specifying that conduit be laid within the walls. The necessity of exposed wiring is thus easily avoided.

As each residence presents its own special opportunities for telephone convenience, no general rules can be applied. It is naturally desirable that the telephones should be sufficient in number and so located as to insure the greatest ease in the use of the service. Quite frequently telephone outlets are provided in rooms where the service is not needed immediately, but may be desired in the future.

Your local Bell Company will be glad to explain the additional features which constitute complete telephone convenience, and to help you in planning telephone arrangements for individual building projects. Call them today.

THE NEW MODE OF INTERIOR DECORATION

A REVIEW BY
CLIFFORD WAYNE SPENCER

WHEN a movement attracts as many followers and creates as widespread a disturbance among people of culture and understanding as does the so-called "modern art" movement, we should endeavor to decide for ourselves, if possible, just what its possibilities are and whether it is to become a lasting part of the world's art or is merely a frenzied attempt on the part of a dissatisfied and restless group of artists to accomplish overnight that which would normally require a period of one or more centuries to work itself out. Certain it is that a vast number of artistic sins are being committed in the name of modern art and that many people without the requisite good taste and background to create objects of beauty have seized the opportunity to foist on an unsuspecting public all sorts of atrocities bearing the *art nouveau* label. On the other hand, there can be no doubt that an underlying current of truth and reason runs through the movement, and that as time goes on a definite and national style will be evolved. As is always the case with a new movement of this sort, there is a tendency to unduly ridicule the efforts of its followers, due largely to lack of understanding of the ideals and aims actuating them. We are very likely to ridicule and make fun of that which we do not understand, and lest we condemn unjustly, it is always well to make an effort to comprehend the viewpoint of those who believe in the new movement before forming fixed and definite opinions.

Much of the published material on this subject has been of such a nature as to still further confuse the earnest seeker after understanding, it apparently being the habit of writers on this topic to envelope the entire subject in a veil of abstractness and absurdity. The simplicity and logic back of the movement is admirably expressed in the book entitled "The New Interior Decoration," by Dorothy Todd and Raymond Mortimer. According to these authors, the new design is a natural product of the age we live in,—the age of science and standardization. The theory is that the beauty that expressed the life of bygone eras should not be borrowed and grafted onto our own lives, but that we should evolve a new set of ideals of beauty inspired by the objects that surround us. The industrial prosperity of the present century is due not only to the invention and development of machinery but also in a large measure to the methods of modern business management. Scientific studies of production methods have been made and have rendered it possible to eliminate from the processes of manufacture much of the lost motion and other elements not absolutely essential to the making of the finished product. It is this elimination of the unnecessary that the modernists claim to be their keynote, and they propose to carry the efficient methods of modern business into the private lives of the people and to express in their surroundings the spirit of the new industrial civilization.

They propose to treat the modern house as a "machine for living in," and claim that "gracefulness in things, as in persons, results from an elimination of the unnecessary,—so that in order for a thing to be beautiful it must be useful." The modern designer "begins with an idea of utility and achieves beauty by careful arrangement and proportion of the necessary parts." Since the furnishing and decoration of a house depend largely on the manner in which the house is built, the authors of this work on interior decoration devote a great deal of space to a discussion of architecture and of modern architecture, which they claim to be a new renaissance of architecture based on the beauty of utility and made possible largely through the use of the new materials,—steel and ferro-concrete,—it being no longer necessary to work within the narrow confines prescribed by the use of brick, stone, and timber. The new materials and new engineering science permit of previously impossible shapes and sizes, and this gives the modern designer unlimited new opportunities. As the authors of the present work point out, "forms in architecture depend principally upon the materials employed, and the contemporary renaissance in architecture comes from the discovery of a new material,—reinforced concrete. With the use of a steel framework, the break with the old forms became a logical consequence. The first possibility afforded by these materials is that windows can stretch from wall to wall of a room, from one concrete support to the next. A house, if desired, may be entirely walled with glass. Hitherto the width of windows has been limited by the material,—stone or brick or wood,—which spanned their tops. It has been usual to light a room with tall, narrow windows. Today it is possible to use the more logical method of having a window at the level of the eye running the entire width of a room. In this way the general appearance of the facade at once changes. Horizontal lines dominate, and the ground floor plan dictates the form of the exterior."

Modern life is characterized by a tendency to concentrate a large number of people in limited areas, so that it has become, "more economical, as well as more harmonious, to build houses in series instead of singly. By standardizing various types of houses it is possible to enormously reduce the cost. The individual house is already an anachronism in cities, for the nineteenth century practice of making a street a collection of narrow houses, like towers, is utterly unpractical. But it is possible to build enormous buildings, each apartment in which, has its open air terrace and garden. To facilitate this and to give light and air to streets, the buildings in the centers of cities are bound to approximate in form increasingly the pyramid. Already the zoning laws in New York are resulting in buildings of this sort, but in cities, where the space is less limited, the angle of retreat from the street can be advantageously more acute. In the past enormous mansions were built for the rich, confined cottages for the poor. Slowly these inequalities are disappearing. The modern house or flat needs to be large enough for a small family, and no larger, for the diminution in the supply of domestic servants is certain to continue. The modern architect is solving the problem by building the house as one large room with alcoves and balconies intended to serve various purposes."

In treating interior decoration, the subject is divided

into two parts,—one on continental decoration and the other dealing with English and American decoration. The history and development of decoration have been closely bound up with that of architecture, and as in architecture the first requisite of good furniture is utility and comfort; especially is this true as regards chairs and beds. "With regard to the actual decoration of a room, there is naturally great variety of opinion. Le Corbusier advocates extreme simplicity,—color-washed walls; tiled or composition floors; unshaded opaque electric light bulbs hanging from metal pipes or ordinary twisted electric wires; no curtains; bent wood chairs; metal desks; and the pictures,—if any,—carefully placed to focus the architectural forms of the room. The habit of concealing radiators in framework of Louis Quinze design is naturally abhorrent to these decorators, who not only reject all 'period' decoration as unsuitable to the present, but delight in emphasizing the beauty of function. There is usually no attempt to mask gas or water pipes that run along the wall." Whenever possible, furniture is made in the form of built-in fixtures and becomes definite parts of the architecture of the room. "Economy in labor as well as the increasing demands of hygiene, receives in the modern house an attention it never received before. For floors a composite material of cement, sawdust and cork is now much used in France. It is durable and easily cleaned without being noisy, and can be procured in various degrees of hardness. Today our hygienic dislike for dust has led to a positively æsthetic preference for such objects as least collect it. A room crammed with dust traps offends our eye, and as a result there is a tendency to use American cloth where our parents would have used velvet. Chairs and tables can be painted with the same hard enamel which is used for motor car bodies, which neither marks with wet nor can be easily scratched."

Opposed to this school of decoration there is the more conservative work of the English decorators, whose problem more often consists of transforming an old interior and making it suitable to the uses of an up-to-date civilization. In this they have been particularly successful in creating a more intimate type of treatment. The authors of the present work admit that while from their point of view there is practically no worth while contemporary English architecture, "it is arguable that their interiors are better suited to contemporary sensibility than the austerer work of the French school. The mechanical forms, the absence of all caprice, it may be said, will possibly suit the civilization of the future. They seem intended for Robots, rather than for human beings. As life grows more uniform and is increasingly dominated by machines, we may wish in our homes to escape from this impersonality. We need fantasy, imagination, within our houses. We want to relax, to enjoy intimacy, to feel,—as well as actually to be,—comfortable. The Le Corbusier style of decoration is as formal as the old French *salon,* which had hard backed chairs at regular intervals all around it. We require our homes to be more quiet, more informal, more personal. It is difficult to say that one of these attitudes is right, and the other wrong." As to American architecture and decoration, the authors are somewhat non-committal, merely expressing a vague hope that "the approaching years are likely to witness a vigorous revival of original design."

About half of the book consists of a plate section showing illustrations of examples of work in all phases of the modern design. The work of Le Corbusier receives considerable attention and is represented in illustrations of many rigidly severe interiors, including an entrance hall in which the heater with its accompanying smoke pipe and water pipes constitutes the predominating decorative feature. Many of the interiors which follow are perhaps more intimate and somewhat more cheerful, and yet in all the impression is one of that clean barrenness which one usually associates with the interiors of refrigerators or hospitals. The illustrations of furniture include many extreme types, such as chairs consisting of pieces of bent pipe over which are stretched pieces of cloth or other material. These certainly constitute a good illustration of the "principle of the elimination of the unnecessary," and although they may have been designed to give a maximum of comfort they certainly do not give comfort to the eye. Mural decorations by Duncan Grant and Vanessa Bell are allotted considerable space and illustrate some of the best work of the modern English designers. The fabrics, rugs and tapestries shown are very interesting and in many cases attractive, since this sort of material lends itself more readily than some others to the forms of modern art, and the new fabric designs are often pleasing even to those who do not care for modern art in its other forms.

The final chapter is devoted to a description of the practical methods used in obtaining the modern effects, and for those who wish to try their hand at the new decoration, it should furnish many pointers and much valuable information on rearranging older rooms in the newer manner. Advice is given as to the selection and arrangement of furniture and fittings, methods of lighting, floor coverings and carpets, and curtains and textiles.

For those who wish to know what the new movement is all about, this is perhaps as sanely written an explanation as has yet come to our attention, and the illustrations indicate the tendencies of some of the better class of interior decoration in the modern manner. "The authors do not consider that all the experiments illustrated are successful; but they have tried to choose illustrations representative of the best work known to them. They believe that the twentieth century is likely to be distinguished by an important renaissance in architecture and the arts subsidiary to it, and it is their hope that this book, incomplete as it is, may help to persuade others of this exciting possibility. They have deliberately excluded from their survey all work in which traditional styles, even in modified forms, are apparent." They also claim to have excluded all work claiming to be modern but which is "only eccentric." The uninitiated, on viewing the frontispiece might be led to wonder just where the distinction lies! As has already been said, this new type of decoration and furnishing should be studied and its philosophy examined before an opinion is formed. Nothing worthless could have aroused such enthusiasm and enlisted so many earnest followers, and even the most conservative sometimes admit (though perhaps reluctantly) that in some of its more moderate aspects the style has a certain charm as well as interest.

THE NEW INTERIOR DECORATION. By Dorothy Todd and Raymond Mortimer. 92 Plates, 42 pp., text 8½ x 11 ins. Price $6. Charles Scribner's Sons, 597 Fifth Avenue, New York.

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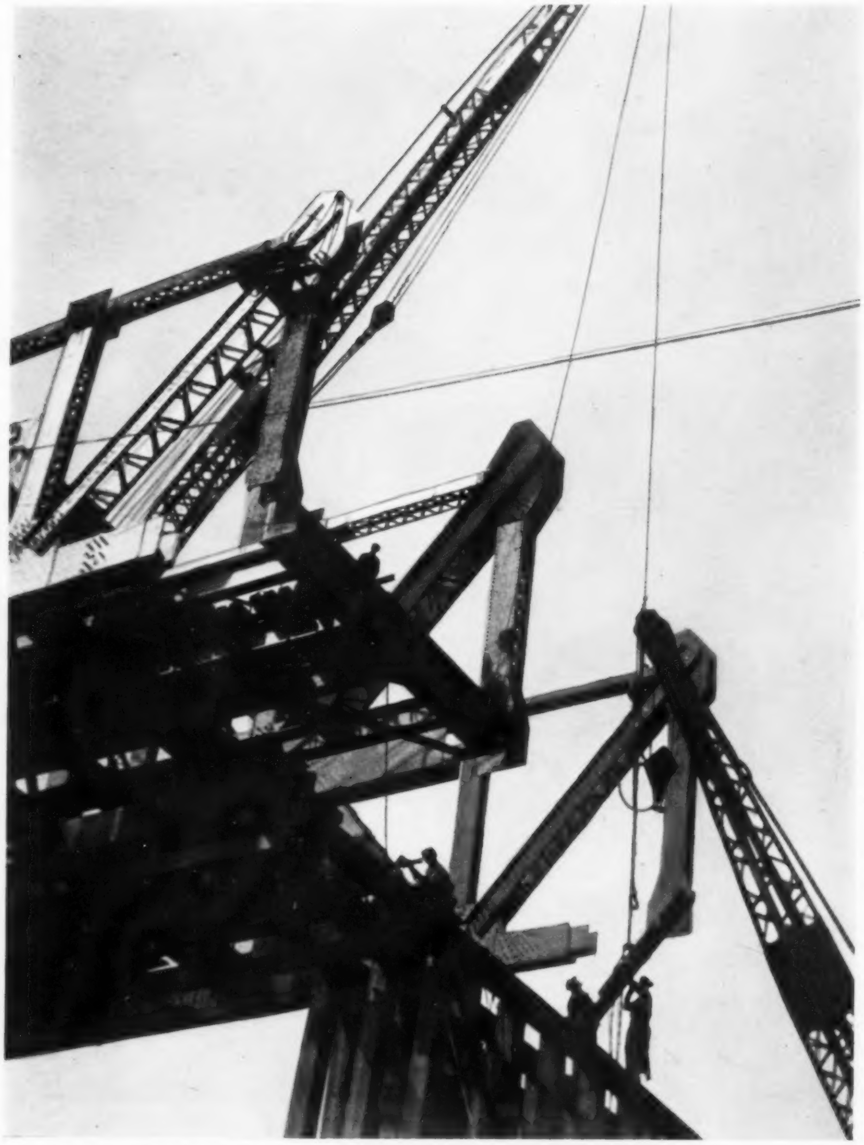

PLACING TRUSSES
APPROACH TO NEW CLEVELAND UNION TERMINAL

From a Photograph by Margaret Bourke-White

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JULY 1929

MINIMIZING HEAT LOSSES IN RESIDENCES

BY

P. E. FANSLER

NOT so long ago the heating plant was just a heating plant; the architect was chiefly concerned with the æsthetic side of his profession, and with the attempt to reconcile his clients' usually hazy and frequently absurd demands with the possibilities in structure and design. Having accomplished this essential task, the architect generally passed on, *in toto*, the problem of heating to the local artisan, of plumbing to the specialist in that line, and the lighting to the electrician.

Today, due largely to the intensive research that marks the age, heating plants for homes, as well as for commercial and industrial buildings, have reached a stage of specialized development, and the architect who would intelligently advise his clients is forced to inform himself regarding the highly perfected equipment now available.

With growing consciousness of the need for and possibilities of economical heating plants has come an appreciation of the fact that there is little use in specifying and having installed a highly efficient heating plant unless an equally intelligent effort is made to conserve the heat that is generated. Consequently, we find a rapidly growing industry, nurtured largely by the heating industry, concerned with the conservation of heat.

An important factor in the rapid development in this field is the research that has been carried on during the last four or five years, first at the research laboratory of the American Society of Heating and Ventilating Engineers, and later, under the guidance and correlating influence of the society, extended to the research laboratories of nine great technical schools. Far from being an academic and impractical sort of research, this has been so thoroughly practical that the data developed have had almost immediate application to the problem of more efficient construction.

Where Heat Goes. This article is but a brief summary of the problem of preventing heat developed by the heating plant from "heating all outdoors." Obviously, all of the heat generated in the boiler or furnace during the entire heating season does "escape" from the house; otherwise the house would grow hotter and hotter until spontaneous combustion would be initiated. But if the *rate of loss* can be reduced to the irreducible minimum, the fuel requirements of the owner also will be at a minimum. The problem, then, is to *minimize the rate of heat loss.*

Analysis of the problem shows that fuel is consumed to replace heat lost (a) through the walls, (b) through the window glass, (c) through ceilings and roofs, (d) through doors that are, from time to time opened, and (e) through infiltration, i.e., in heating to room temperature the cold air that filters in through cracks around windows and doors and, in poorly constructed houses, through the walls themselves.

A study of a large number of typical houses shows that these losses average about in this way:

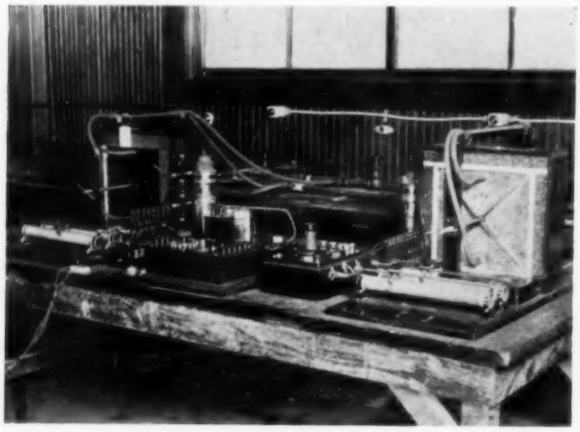
(a) Heat loss through walls, 27%
(b) Heat loss through glass, 26%
(c) Heat loss through roofs, 16%
(d) Heat loss through opened doors, 4%
(e) Heating infiltrating air, 27%

It is to be seen that three of these items constitute 80% of the total loss of heat; it remains to be seen how much these items can be reduced.

Reducing Wall Losses. Briefly, heat loss through walls depends upon the wall area and the coefficient of heat transmission. This coefficient is the number of British thermal units transmitted per hour, per square foot of area, per degree Fahr. difference between the inside and outside air temperature for such air conditions as exist in the coldest weather in the locality under consideration. Designated as "U," this coefficient then becomes a direct measure of the ability of any wall structure to retard heat flow.

Coefficients for typical building construction of today are given in Fig. 1 and these typical types of present-day practice. As the largest and smallest values of U are approximately in the ratio of 2:1, it is evident that the best wall construction will allow heat to escape at about one half the rate of heat loss through a wooden wall of cheap and common construction. If, then, a house has a gross wall area of 2,400 square feet, with 20% windows, the net wall area will be 1,920 square feet, and the heat loss through this wall will be slightly less than 30% of the total heat loss for the house. If the house were built of frame construction of the better sort, wood lath and plaster on one side of the studding and sheathing, building paper and lap siding on the other, the transmission coefficient would be 0.222. If, however the lap siding were replaced by stucco on metal lath, and if the spaces between the studding were completely filled with a poured insulation, the coefficient would be reduced to 0.110—almost exactly one half that of the uninsulated construction. With this latter wall then, it would be possible to save about half of the 28% heat loss charged to the net wall area, or 14% of the heat that would be lost through the cheaper construction. Other materials properly applied could produce a wall equally as heat-resistant.

Heat Loss Through Glass. Taking the heat loss through the glass of our typical house as 26% of the total loss from the house, we are immediately faced with a difficult problem in trying to reduce this loss. The quality of glass and the thickness have practically nothing to do with it. A double glass window, if the two panes are close together, approximately one quarter inch apart, transmits less than one half the heat passed through a single thickness of glass, but practical difficulties, such as keeping moisture and dirt from the inner surfaces, put a damper on such usage. If use of three panes were practical, this 26% loss could be reduced about three quarters.



Apparatus for Testing Heat Conductivity of Building Material by Hot Plate Method

Roof Losses. Losses through roofs vary even more than through walls. For a roof with wood shingles on wood strips and with nothing on the under side of the rafters, the coefficient may be taken as 0.50, while with the same construction with the addition of 2-inch sheets of corkboard nailed to the under side of the rafters and plastered on the inside, the coefficient would be almost exactly one fifth as great. An equally heat-resistant construction would be shingles over wood strips, wood lath and plaster on the under side of the rafters, and the spaces between the rafters evenly filled with an insulating material. There are, of course, many insulating materials and many more combinations of structural and heat-resistant materials. Thus it will be seen that it is possible to save, as between the poorest and best roof construction, about four fifths of the 16% of the heat loss of our average house.

The loss attributed to opened doors is quickly disposed of; it is small, and it is hardly controllable by the architect.

Infiltration. Cold air entering through the walls, and through cracks in and around windows and doors, as the result of wind pressure on the house, requires an expenditure of fuel as great as that required to offset the heat loss through the material walls,—almost 30% of the total. This loss can be materially reduced (a) by the use of high class weather strips, properly installed; (b) by applying so-called storm windows, properly calked, on the windows taking the brunt of winter winds; (c) by installing, when the house is built, windows and doors having a minimum of cracks, both in length and width; (d) by reducing the number of windows on those sides of the house exposed to normal winter storms; (e) by calking the cracks between window and door frames and walls, and (f) by giving careful attention to the construction of the walls themselves. Here we find many factors contributing to the loss, and as many possible ways of minimizing the wastage of fuel.

In many classes of construction metal windows are being used more and more, and manufacturers of this kind of equipment are leaving no stone unturned to produce windows that will be as nearly air-tight as possible. As an example of the leakage of residential casement steel windows, a test at the University of Michigan showed, with an indicated wind velocity of 20 miles an hour, and with the window as tight as good manufacturing and installing could insure, a leakage of only 25 cubic feet per hour per linear foot of movable portion of window. To illustrate the effect of a slight opening,—with 1/64-inch shims placed between the weathering contacts at the

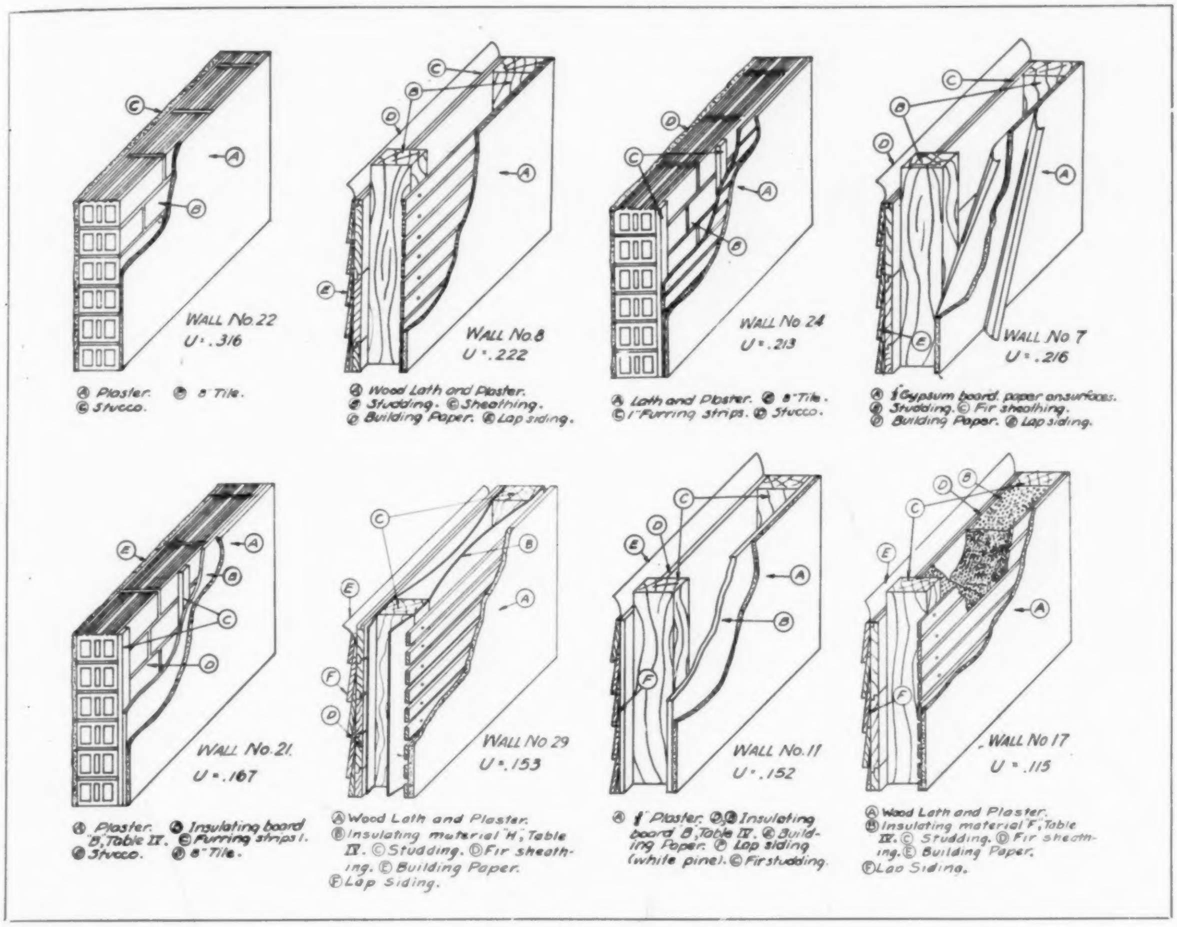


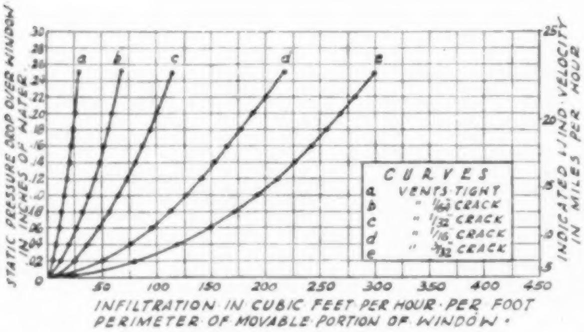
Fig. 1. Common Types of Wall Construction. The Smaller the Numerical Value of "U," the Coefficient of Heat Conductivity, the Better the Wall as an Insulator

swinging edge, the leakage was 100 cubic feet,—four times as great,—while with the crack increased to 3/32 inch, the air streamed through at the rate of 260 cubic feet per hour. It will be evident that the architect who makes a careful study of infiltration prevention can render a real service to his client who builds a house but once and buys fuel every heating season.

Quantitative Tests. The earliest studies to quantitatively determine heat loss from building structures were made on walls and roofs. These showed how widely the rate of heat loss varied with the individual materials and with the methods of using and combining them. The derived data stimulated the American mind to discover preventatives of heat loss,—and the era of house insulation began. One of the most important aids to the advancement of knowledge of heat loss through walls and roofs is the heat-flow meter, developed from a crude laboratory device to a practical field instrument by Percy Nicholls, physicist at the U. S. Bureau of Mines experiment station, Pittsburgh. This device is applied directly to the wall or roof under investigation and permits the instantaneous and direct measurement of the *rate of heat flow.* Naturally it indicates flow inward as well as outward, and one of the most fascinating evidences of its sensitiveness occurs when it is attached to the under side of a roof. On a bright day, when the rate of flow is approximately constant, the passage of a heavy cloud over the face of the sun is almost instantly shown by the meter reading.

It has been determined, through the use of this meter, that the flow of heat through a new wall is not what it will be under identical temperature conditions when the wall has aged. Also, when the wall is wet after a rain, the resistance to heat flow is not what it is when the wall is dry. Furthermore, the wide variations found in concrete walls, due to differences in "mix" and method of construction, have corresponding variations in heat flow.

Data on heat flow through homogeneous materials were both abundant and accurate, thanks to precise laboratory tests, but when it came to determining heat flow through typical composite walls of modern structures, the heating engineer



Curves Showing Infiltration Through Metal Casement Sash Under Various Conditions

was hard put to it. The conductance of a composite wall (the B. t. u. transmitted per square foot per hour per degree Fahr. difference between surface temperatures) had, in the past, been computed by an empirical formula, depending upon values experimentally determined; the accuracy of the final result also was open to question.

The worth of the heat flow meter in checking values of conductance of composite walls for which the computed values were known, as well as for finding values for walls difficult to handle by formula, at once became apparent. An elaborate series of field tests made during the last year, offers illuminating information on this subject.

The three last items indicate the interesting findings in regard to concrete, brick and tile, the fact that computed figures previously accepted probably are not accurate, and that a wide divergence exists in conductance where concrete is one of the elements, due to the wide difference in physical characteristics and the lack of uniformity in a given wall. Because of this discovery, a great deal of attention is being given to this phase of the study, and it is expected that both the range in actual values and safe average figures will be determined.

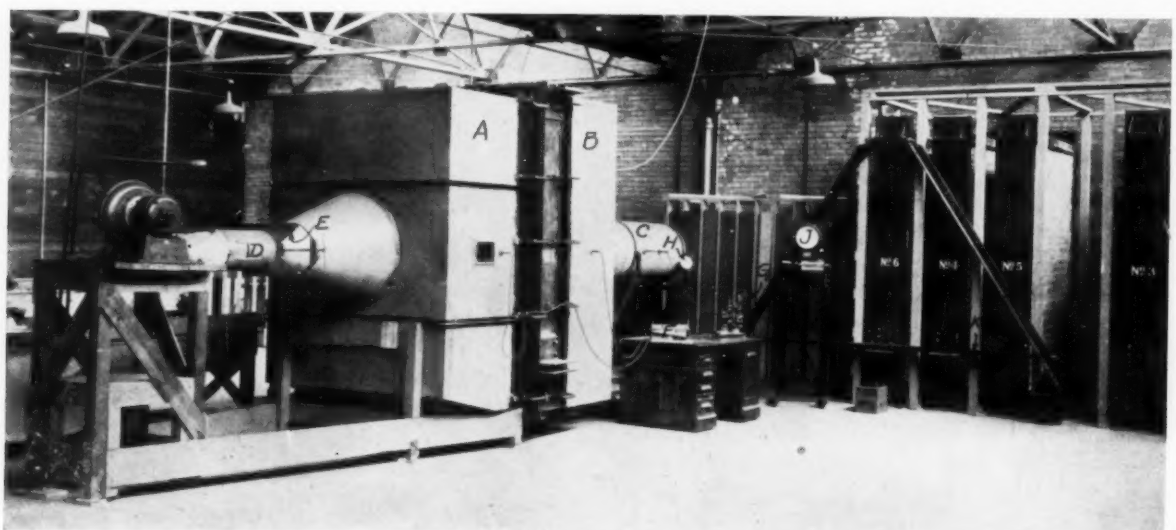
Here are some of the data obtained:

Construction	Conductance As measured	Conductance As computed
2¼″ T. G., felt, 3/16″slate..	0.36	0.37
1⅜″ plaster on wire netting	1.64	1.68
Guaranteed 5-ply roofing, 1¾″ pine	0.46	0.48
4″ brick, 8″ tile, plaster, paint	0.30	0.31
Plaster, 3″ gypsum block, plaster	0.87	0.88
13″ brick, plaster..........	0.28	0.30
Clapboard, paper, sheathing, studding, lath, plaster, wall paper (which surprised the investigators)..	0.28	0.27
8″ concrete slab, 1:2:4 mix..	1.79	1.04
8″ concrete slab, 1:2:4 mix..	1.66	1.04
4″ brick, 8″ tile, plaster....	.60	.31

As might be expected, some unlooked-for results were obtained during a long series of field tests with the heat flow meter. During the study of heat flow through a tile, brick veneer wall, there was a decided drop in temperature, followed by a gradual rise. The low temperature continued over a three-day period. The salient data obtained are given here:

	Jan. 13	Jan. 14	Jan. 15	Jan. 16
Lowest outside temperature	40	23	18	20
Highest rate of heat flow (actual)	9.5	11.4	15.3	15.7
Highest rate of heat flow (theoretical)	8.9	14.0	15.6	15.1
Per cent of theoretical of actual rate of heat flow	93.7	122.1	102.0	96.1
Total heat flow for 12 hrs., (actual)	72.2	122.4	168.3	143.3
Total heat flow for 12 hrs., (theoretical)	106.7	168.0	187.2	153.6
Per cent of theoretical of actual total heat flow..	147.8	137.2	111.2	107.1

It is evident that the maximum measured rate of heat flow increased as the outside temperature

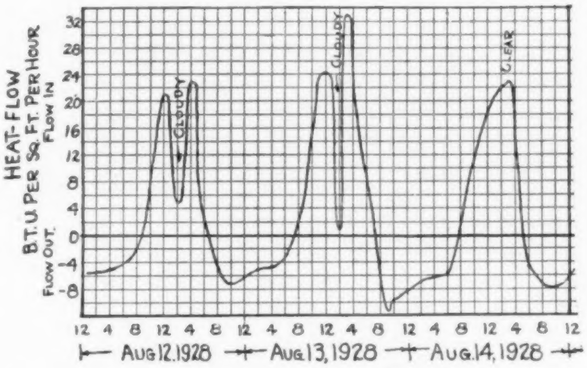


Testing Equipment for Determining Air Flow Through Brick Walls. Several Test Panels Are Shown at Right

dropped, but not as rapidly as the theoretical rate of heat flow found by multiplying the conductance of the wall by the temperature difference. When the outside temperature started to rise, the measured rate of flow became greater than the theoretical rate. Lag in heat loss, due to the heat capacity of the wall, caused this condition, which was not fully appreciated until brought to light by these tests. The total heat loss over the 12-hour period as measured was less than the computed loss, based upon a continued maximum temperature difference over the entire period. This condition should be taken into account when estimating heat losses from buildings involving large wall masses capable of storing heat.

Another interesting finding developed through tests on the walls of the Hotel Schenley and of the Schenley Apartments, Pittsburgh, both being 4-inch brick, 8-inch tile and plaster. The conductance of the walls of the former, as determined by the meter, was almost exactly twice that of the latter. A study of the possible reason led to the fact that the heat-flow meter had been applied to a narrow strip of wall in the hotel, with an edge close to a window and another adjacent to a wall. Undoubtedly the lines of heat flow through the wall spread out from the inner to the outer surface, causing the discrepancy. From this, the operators learned to be more careful in choosing a location for the meter. The next year or two undoubtedly will see the accumulation and tabulation of a great many figures that will render more accurate the determination of heat losses from all portions of buildings of every class.

Insulation. Turning from a classification of heat losses through walls and roofs to the problem of reducing these losses to the economical minimum, there are to be considered three classes

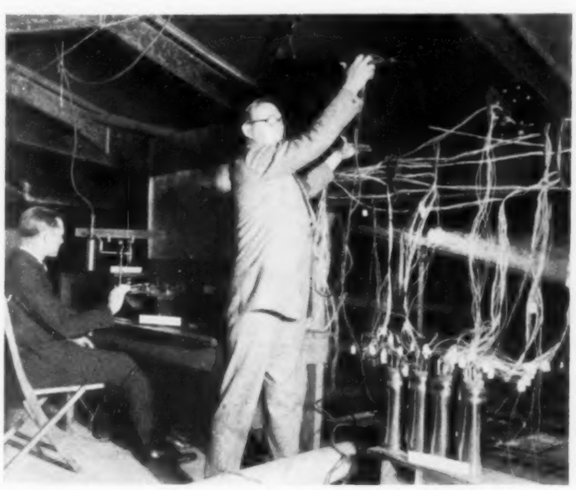


Graphic Record of Heat Flow Through Roof Showing That Cloudiness Reduces Inflow

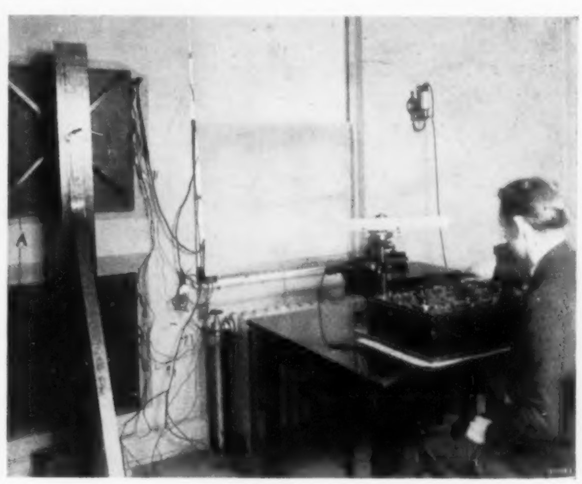
of insulation: rigid boards, flexible, and "fills." Each has qualifications for specific applications. Practically every type will absorb water to some extent; and insulation, when moist, ceases, in a large measure, to fulfill its function. Where there is a chance that condensation will occur, some effective waterproofing should be provided. Fire- and vermin-resisting qualities also should be given consideration.

Modern buildings designed for factory or office use usually have so much glass in proportion to wall surface that wall insulation seldom is warranted. The window area may be 60% to 70% of the aggregate exposed wall area, and the heat loss through 1 square foot of glass approximates that through 4 square feet of conventional 13-inch brick construction. So the heat loss through the wall is practically negligible.

It is in the home, where comfort is paramount, that insulation is more than justified. With about one-fifth of the wall surface glass, the remaining wall area is well worth insulating, to say nothing of the roof. A plain brick wall is more of a sieve than is popularly assumed. With a 15-mile wind,



An Early Form of Nicholls Heat Flow Meter Used in Testing Roof



Measuring Heat Flow Through Walls of Hotel Schenley

it will pass about 7½ cubic feet of air per square foot per hour. The addition of a coat of plaster on furring will reduce this to one-fifth of a cubic foot. Insulation will reduce this air leakage to an almost negligible amount and, at the same time, reduce the heat loss through the wall.

Workmanship and Heat Loss. A comprehensive series of tests recently has been made at the University of Wisconsin to determine the rate of air infiltration through brick walls of various kinds. An elaborate test equipment was so constructed that sample sections of wall could be inserted between two air chambers, with all peripheral joints thoroughly calked. Air pressure was produced in one of the chambers by a blower, and the air that passed through the wall into the other chamber was emitted through small calibrated orifices and its quantity measured.

Test wall sections were built up of two classes of brick,—hard and soft,—and in such a way as to differentiate between good and poor workmanship; in the latter, the mortar was "skimped" between the two outside surfaces of the wall, *but the outside appearance was identical.* Great variation was found in the air-passing character of the different walls. Careful analysis of a mass of data showed that there were many factors, and that reasons for certain results were more conjecture than anything else. Of the results, Professor Larson says:

"Since poor workmanship consists mainly in leaving voids between the bricks in the interior of the wall, and since the porous brick is likely to be much less uniform in density, it may be that poor workmanship opens up passageways for air through short distances from the face of the porous brick to the voids, and then out on the other face of the wall through a short distance of brick. This explanation requires that the hard brick wall passes most of the total infiltration through the mortar joints."

"Another possible cause for this greater variation between the best and the poorest of porous brick walls, as compared to the best and poorest hard brick walls is in the effect of the porosity of the brick on the proper setting of the mortar. It is likely that the porous brick draws the water from the mortar before it has had time to set, and consequently causes an opening of pores and shrinking away of mortar from the brick surfaces."

It will be evident that the architect, by insisting on the highest class of workmanship and materials, and by watchful inspection during the construction of brick walls, can insure to his client walls that will pass a minimum of air, and consequently result in materially reduced fuel bills and provide more comfort for the occupants.

That the economic thickness of insulation can be determined from essential data is shown in a typical analysis recently made by M. S. Wunderlich, in which he assumed:

An annual heat demand of 6,000 degree days.
Anthracite coal at $17.00 per ton.
Coke at $12.50 per ton.
Bituminous coal at $9.00 per ton.
½-inch insulation at $90.00 per 1,000 sq. ft., applied.
1-inch insulation at $130.00 per 1,000 sq. ft., applied, and where 1-inch insulation is applied to side walls, $15.00 is added per 1,000 sq. ft. to take care of additional depth of window and door frames, the insulation being installed to take advantage of air spaces and having a conductance of 0.30 per unit inch.

The conclusions drawn by Mr. Wunderlich are thus summed up:

"From this table it will be evident that the saving with 1-inch insulation in the ceiling, with $17.00 per ton coal, is slightly greater than the saving with ½-inch insulation in the side walls, and that with $9.00 per ton coal the saving with 1-inch insulation in the ceiling is slightly less than the ½-inch insulation in the side wall, while with $12.50 per ton coke the saving is the same. This would indicate that with a higher fuel cost the insulation in the ceiling should be increased over that indicated as compared with side walls, and that with $9.00 per ton coal the thickness of the ceiling insulation approaches the thickness of insulation of the sidewall. Therefore, it follows with the average cost of fuel to the home owner, that the ratio of ½-inch insulation in the side walls to 1-inch insulation in the ceiling is a well balanced insulated job."

A HOUSE FOR MASS PRODUCTION

BY

R. BUCKMINSTER FULLER

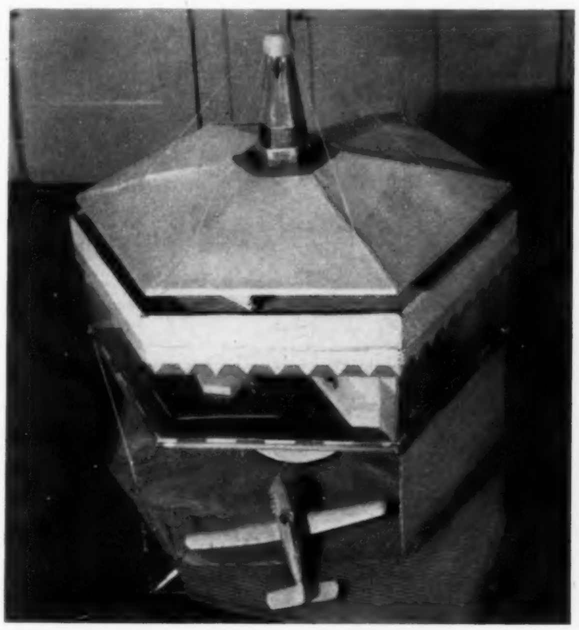
Editor's Note. The brief but illuminating and stimulating description of this house is taken largely from an address by Mr. Fuller, in Chicago, where his models were first exhibited.

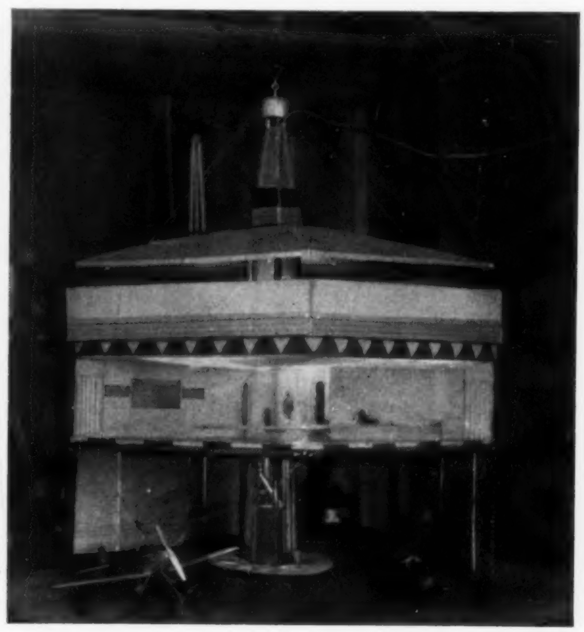
IT must be clearly understood that the models and drawings here presented are in no way assuming of perfection or that they indicate the only solution of a problem. They do, however, represent a very definite attempt at housing design on a 'best-for-all' basis, with no concession to material appearance or to vanity in advance of proper engineering and general scientific solution. By vanity is meant an association of ideas as to how something should be done because in the past a solution has been related to some event or person of whom we are fond, rather than to solving problems on the basis of their clearest reference to intelligence.

"Inasmuch as the major abode of the United States,—and it is assumed for discussion that the United States represents the advanced nations of the world,—is still the five-room individual house, and inasmuch as but 1 per cent of the five-room houses are designed by architects, it being economically inexpedient in a 'tailoring' business to design so small an entity, and inasmuch as the majority of these individual houses of the United States have still no bathrooms, there is indeed involved a problem of industrial best-for-all design.

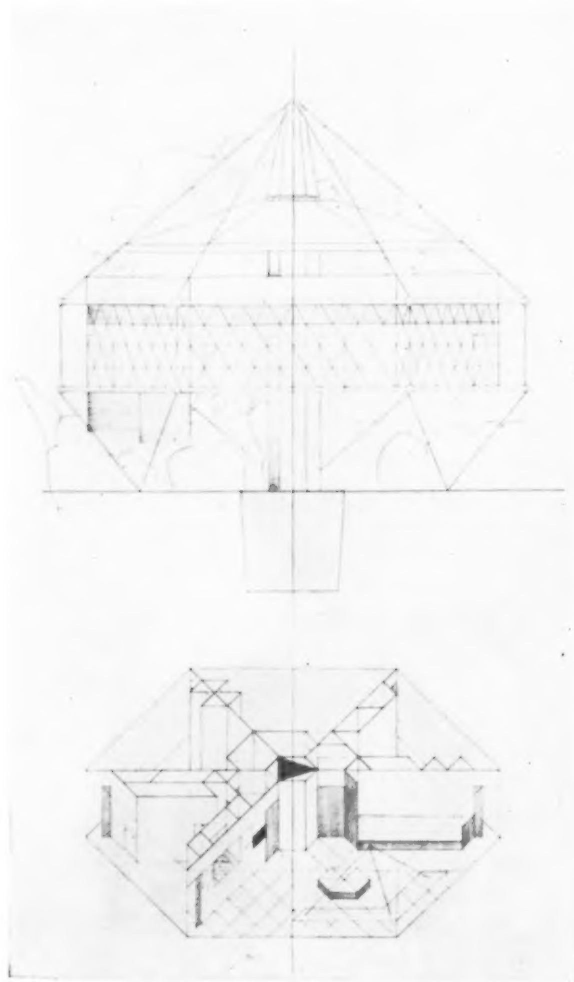
"That there are 2,000,000 people who die in houses annually from floods, earthquakes and tornadoes, that there are multi-millions who die from unsanitary housing conditions, all of which can be overcome mechanically with no effort at all, indeed emphasizes the problem that there is a best-for-all solution. Inasmuch as we are all here in this world to live, and the one thing we need most is housing, housing on an industrial basis of fabrication, as opposed to the picayune 'tailoring' business it is today, would be in proportion to all other businesses as the battleship to a small boat. It has been found that the great popular buyers for monkey wrenches, automobiles, hats, etc., cannot purchase housing as they want it, there being no centralized industries on a universal competitive basis to overcome the exigencies enumerated before, to economically survive on their claim that they can overcome them, and so perform.

"This house is 40 feet high, 50 feet in diameter, proof against earthquake, flood, tornado, electrical storms, marauders, etc. It contains two bedrooms, each with its bath; foolproof worm-gear elevator; laundry unit in which each piece of soiled clothing is individually deposited, and completely finished and ready to use in 3 minutes; cooking grills which are like a piano and

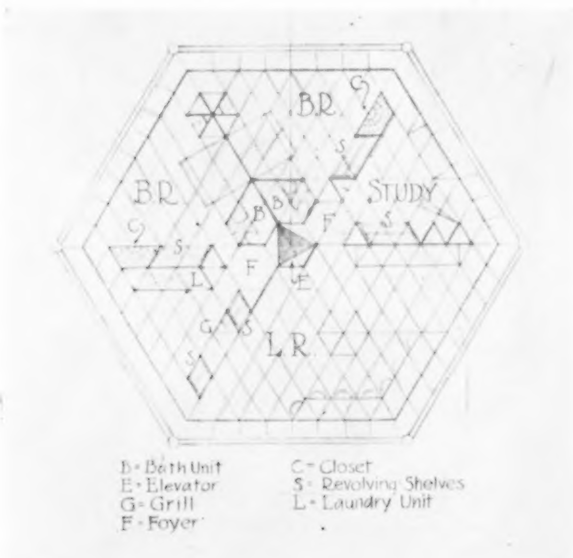




Two Views of a Model of the House Designed by Mr. Fuller to be Produced by Factory Methods on a Quantity Production Basis



Elevation and Isometric Drawing of the Dymaxion House, Showing Stability of Construction Obtained by Triangulation of Steel in Tension



Plan of Dymaxion House Having Living Room, Study, Bedrooms with Baths, and Service Room

have nothing to do with a servant; refrigerator; dish closets in which the shelves come around to one instead of one's going around for them! incinerator pocket in which one shells the peas, etc., without ducking down under the pipes; pneumatic, soundproof floors and doors on which the children cannot hurt themselves; library in which the bookshelves come around to one, completely equipped with maps, globes, atlases, drawing board, typewriter, mimeograph, calculating machines, television unit, radio loud speaker and microphone; individual power plant providing both light and heat; sewerage disposal; compressed air cleaner; pneumatic beds; built-in furniture; semi-circular hanging coat closets with capacity of 32 overcoats or 50 dresses; hangar in which the transport unit, an amphibian airplane-automobile, is found as part of the equipment of the house; a 50-foot diameter play deck on top of the house sheltered from storms but where sun baths may always be had; windows that cannot be broken and are never opened, as the air is brought in mechanically without losing any of its fresh, spring smell, but freed of all dust and combined with the proper amount of humidity,—air never too wet nor too dry—and of the proper temperature, blown in through the rooms so that at the North Pole or at the equator no bed clothes need ever be used as the air is always perfect; where any amount of light or coloring of the light may be had in any room from completely indirect, translucent lighting of ceilings or partitions; rooms that are all soundproof so that when anyone rests he may rest in perfect peace. All delivered and ready to move into complete as described, it weighs but 6,000 pounds; at 50 cents a pound for this combination of conveniences, which involves aluminum, casein, etc., it comes to but $3,000 delivered. This house, apparently from cost of Diesel engine operation figures now current, can be maintained at a total expenditure of $5 a month. Being on a functional basis of design, like a ship, it can now be sold not on the land it occupies any more than the ship on the water it occupies, but on the acceptance time-faith basis of all other products.

"It is evident to all the most ardent æsthetes that such truth can also be beautiful. With such apparent results to be obtained on a best-for-all basis, it is evident that should the great industrial housing so indicated develop, which it must inevitably do, all other forms of housing extant will be obsolete and we will need at once 2,000,000,000 houses, let alone factories, office buildings, etc., of equivalent economic engineering economy, wherefore none need fear of being bereft of their business provided they realize that good prestige and organization, rather than material inventory, form their chief stock in trade."

PHOTO-VISUALIZING FOR ARCHITECTS

BY

LEICESTER K. DAVIS

ILLUSTRATED FROM PHOTOGRAPHS BY THE AUTHOR

NOT for one moment is this article intended to go on record as recommending that survey photographs be made to take the place of professionally produced progress pictures which are now so thoroughly relied upon for records of the major phases of modern construction. The points which it emphasizes are meant solely to aid those who have need of accurate visualizations of subjects which cannot wait for, or perhaps do not justify employment of, the commercial camera man's skill and equipment.

Architects and engineers, construction superintendents and field investigators have assured me that failure on their part to make more use of the little camera as a survey instrument has been due merely to not knowing "how it should be done." Time and again there is need of visual surveys: records of structural practice; details of construction rapidly assuming change of form or being lost to view beneath concrete, brick or plaster; good and bad methods of handling or storing material; incidents which to be of practical value as part of reference data must be secured on the spot, without delay. "I've tried making such photographs," one architect recently said to me, "but with very few exceptions, results haven't justified the bother of lugging a camera about. Most of my stuff has come out all wrong,—important details lost in inky shadows, craftsmen in action looking like woolly dolls, close-ups that make your eyes ache trying to see what they are all about, and distortion that's like a bad dream. It simply can't be done,—by me at least."

It can be done, however, and should be by every architect, engineer or supervisor who knows the value of recorded day-to-day impressions that only a clean-cut photograph can give as irrefutable evidence for future reference. To back that assertion, let's begin with consideration of the qualities demanded in such photographs.

Pictorial effects have no place in the photograph that's intended to become part of a permanent record of structural facts. Niceties of composition, intriguing play of lights and shadows, have no value. Detail is what we are after, —all of it that can be secured, with identity and relationship of elements made clear and brought out needle-sharp, and faults of material or method shown beyond a shadow of doubt.

"That's all true enough," says the man who consistently has had the reverse of such results. "I know as well as you do what makes a successful survey photograph, but how would you handle a problem like this? I want for my files a picture of methods employed on an installation that's in progress. In another half-day it will be out of sight behind courses of brick. I've a particular reason for wishing to show the workmen on the job in action and unaware that a photograph is being taken. It's a dark day with rain, and never a chance for a peep of sunlight. And to get this picture I've got to perch on a scaffold, 20 feet from my subject. That's a fair sample of actual conditions *I've* been up against." A creditable survey shot in a situation such as that would be hopeless if attempted with equipment of insufficient capabilities, but it would be no problem at all with the right sort of camera. To prove that, before we go further, just examine, on page 106, a reproduction of an actual survey photograph made in the rain, under light conditions worse if anything than those just described. No one could wish for more detail, particularly in the heavily shadowed portions. This photograph was made during an inspection trip with a little camera not much larger than a notebook, taking a 2¼ x 3¼-inch picture. Its ability to do the work lay, of course, in better than average lens and shutter,—in a lens having reserve speed enabling it to register details in low visibility, and a shutter adjustable to the exact timing required.

The Lens. The average individual whose experience in photography hasn't gone much beyond the "press the button" stage is far from being certain as to what is meant by "speed" in a lens. Usually he has a hazy idea that it is associated with some special form of grinding or quality of glass peculiar to its type. If at all familiar with the numbers by which lens speed is designated, he realizes that "f :4.5" means an extremely fast lens, while "f :5.6" or "f :7.7" is considerably slower. Beyond that he is not sure as to what it is all about. A good many architects and others who are interested in survey photography, purely as a means to an end, have been surprised to learn that, broadly speaking, the speed of a lens is gauged by the amount of light which it admits to the emulsion-coated film on which the latent image is formed during exposure. A lens is numbered according to the ratio of the diameter of its full aperture to its focal length. For example, the diameter of an f :4.5 will, at full opening, divide exactly 4.5 times into the focal length of the camera for which it is intended, while a slower lens will be of smaller proportionate diameter. This does not mean that mere ability to admit a great amount of light makes a fast lens perfect in its recording. With speed as just

The Little Camera Which Made the Illustrations for this Article. Exposure Meter, Supplementary Lenses, Color Filter and Range Finder Also Shown

defined, there must be refractive qualities that correct aberration and distortion, eliminate chromatic blur and other errors far too technical for discussion here.

The point to be emphasized is that the faster the lens,—considering performance strictly in terms of light,—the greater will be its latitude for effective operation on badly lighted subjects. Correct refraction is quite as important as high speed. No qualities of depth and definition can be too good. For all-round performance under exacting conditions, I can unhesitatingly recommend the Carl Zeiss "f:4.5 Tessar" as being the ideal type for survey work; with its speed are flatness of field, depth, covering power, definition, precision.

Exposure. Correct exposures are, of course, necessary for the success of survey photographs. They must be timed for the details which are most wanted in the finished print or enlargement. The gauging of exposure,—determination of just what fraction of a second or number of seconds are required to get the details,—has made survey photography discouraging to many an architect and engineer whose records might otherwise be crammed with invaluable visual data. Here again, equipment of capacity unequal to demands made upon it has been to blame for a large percentage of failures.

There are several outstanding factors concerning exposure which should be understood. Generally speaking, a survey photograph has to be taken as rapidly as possible. With most views the use of a tripod is both inexpedient and a nuisance. Nine times out of ten there is fast or slow motion as well as fixed detail to be recorded, and the exposure must stop the one while securing the other.

Shutters. With correct analysis of the light with which we are working, there must be latitude in shutter speed that copes with every situation. A shutter of average snapshot limitations falls far short of requirements. As proof of this, suppose one has a camera with shutter adjustable to the usual 1/25-second, 1/50-second and 1/100-second instantaneous range. These will do nicely for everyday amateur picture taking. With an f:4.5 lens wide open it is possible to secure very fair records of street scenes, if not too close upon pedestrians and vehicles, on a cloudy day at 1/25-second. In better light faster action may be stopped by using 1/50-second, while, with light conditions being equal, some very fast action may be stopped at 1/100-second. These divisions are inadequate, however, where bad lighting and motion require timing that borders upon actual time-exposure, or when in brilliant light there is action of "newspaper speed" variety to be stopped.

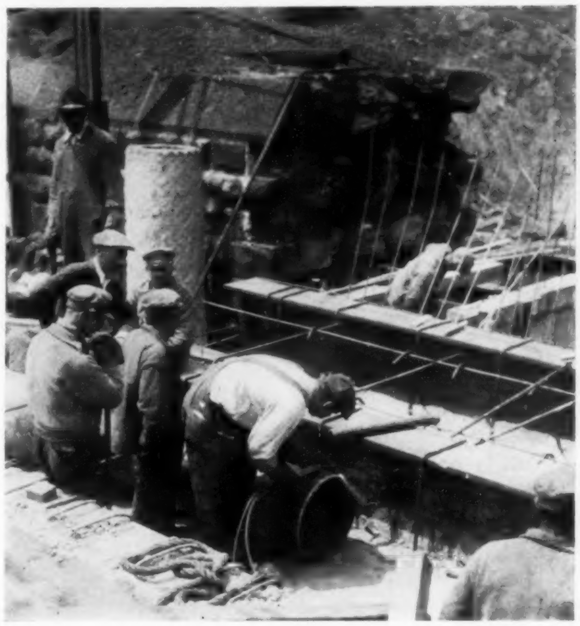
The shutter of the camera selected for survey work should have, in addition to at least 1/200-second maximum speed, a variety of in-between adjustments slower than 1/25-second in order to

A Fast Lens and Slow Instantaneous Exposure Secured This Sharp Result on a Dark, Rainy Day

go the limit when necessary. The "Compur" shutter of the little camera with which all the accompanying illustrations were made offers a choice of eight instantaneous timings: 1-second, 1/2-second, 1/5-second, 1/10-second, 1/25-second, 1/50-second, 1/100-second, and 1/250-second. I find repeated use for all of them. Coupled with the reserve speed of the f:4.5 Tessar, they make few and far between the survey pictures which have to be passed by because of faulty light.

Of course, one must bear in mind that working at slow exposures calls for extreme steadiness of the camera,—1/25-second might be set as the deadline beyond which there is risk of hand or body tremor causing blur in the negative. In some instances, where exigency has demanded a hand-held snap or no picture at all, I have secured remarkably clear and fully timed negatives at 1 1/10-seconds. In others, where the passing of heavy trucks, the grind of nearby machinery, or the shaking of a scaffold under wind pressure has caused vibration, 1/25-second has not been fast enough to prevent disappointing fuzziness of outlines. When vibration or unsteadiness of hand or body is at all suspected, it is well to work with the shutter set at 1/50-second or faster, and if in

Close-ups of Details Such as This to be of Real Value Call for Critical Estimate of Distance



This Sharply Angled Shot at 25 Feet Would Have Been Hard to Get Without the Aid of the Eye-level Focusing Frame

poor light to open up to a lens aperture that calls on whatever lens reserve is required. Experience has taught me the wisdom of securing as firm a camera support as possible for all exposures slower than 1/25-second. The folding strut beneath the lens board of most small cameras usually makes it easy to find a foothold on some rigid object from which focus and exposure may be made with assurance that all movement has been eliminated.

Photographing Motion. It is sometimes surprising to those who haven't figured the thing out how well fast-moving distant or semi-distant objects may be stopped by an exposure that is apparently much too slow for the task. Not long ago, I made an overhead shot of an army airplane laying a smoke screen at well over 150 miles per hour. Just what its altitude above me was I could not say. But through the wire focusing frame the airplane was tiny indeed. At closer range, as any news photographer would tell one, a wide open f:4.5 and many hundredths of a second focal plane exposure would have been required. My lens diaphragm happened to be set at f:8, with shutter working at 1/100-second. There was no time to make readjustment to higher speeds, so I made the attempt, hoping to stop the smoke trail but having no idea that the plane would be more than a blurred speck. The result amazed me; enlarged from the 2¼ x 3¼-inch negative, that plane stood forth as though it had been cut out and pasted on the print. Magnified under an ordinary reading glass, the rods and wheels of its landing gear were sharp and clear.

Some Structural Elements Call for Exposures That Disregard Unimportant Objects. Note Clearness of Essential Details

This instance is cited because of its bearing on those slow exposures where the survey subjects include distant or semi-distant objects moving too fast for close recording. The explanation, given by rule and formula, is, of course, that motion upon the film surface is proportionate to the distance of the object from the film. My airplane experience has stood me in good stead many a time since, when 1/10-second or even 1/5-second exposures made necessary by heavily overcast skies have recorded rapid motion *at a distance*, enlargement later bringing up the details to the size required for reference use.

Essentials for Architectural Photography. Research in photography has been quite as exhaustive as in other major sciences. It has established laws and has reduced them to rules which may be easily understood and followed by anyone. Boiled down to essentials, there are but three points on which the architect who wishes to make successful visual surveys needs to be thoroughly assured. These are: (1) that the lens of his camera be capable of admitting sufficient light for the film to "see" the details he desires in good light and bad; (2) that the lens be capable of refracting the lines, planes and colors of the object with fidelity and freedom from aberration and distortion; (3) that the shutter which regulates the volume of light required to form the image may be so adjusted that the aperture keeps the amount of light static despite changes in exposure time.

Focusing. The most important requirements in lens and shutter have already been discussed. The final element to be considered is focus, produced by the forward and backward movement of the lens and shutter assembly, required to register subjects at different distances sharply on the film. There is no need to go into the principles and laws which govern refraction, conjugates, bending of light waves, circles of confusion and what not. It is enough to say that the distance of lens from object determines the extension of bellows necessary for an image in critical focus. On the base board of one's camera, below an indicator attached to the lens carrier, is the scale which shows what extension must be made to insure sharp focus of objects at various distances. At the start of this scale, where the indicator rests when the bellows are at normal open position, will be found a marking ("Inf." or "Infinity") at which all objects beyond a definite distance will be critically sharp. On the type of camera which is here illustrated, the lens is rated as having 4¼-inch focal length; that is, with bellows at normal extension the lens is at Infinity focus, 4¼ inches away from the film surface. With such a focal length, Infinity begins at about 40 feet, all objects from one-half that distance on being sharp.

Infinity distances vary with focal lengths; the greater the focal length, the greater the distance at which Infinity begins. The ability of the camera of short focal length to perform as a fixed focus instrument at comparatively short range is, of course, a recommendation for its use on surveys. It is hardly necessary to add that the survey photographer should be thoroughly familiar with the focal length of his camera before he takes the field. Little more than these few facts would have to be known were it possible to confine survey photographs to subjects at Infinity. Some of the most important shots, however, must be made at distances shorter than 40 or even 20 feet, and for these detail must be as sharp as possible.

The focusing scale is intended to provide for these close-ups, and it does. But it does not tell one that the moment the lens moves forward of the Infinity mark it has lost ability to register unlimited focal depth. Only so far and no farther, depending upon the point at which the indicator is stopped, will the distances before and beyond the object produce sharply focused images. The more the lens is advanced, the shorter these distances become. It would be bewildering if this information and nothing more were given as an aid to close-up focusing where it is

not possible to see on the ground glass exactly what will be secured in the negative. Luckily, it has all been worked out by formulæ. These have been tabulated for easy and accurate reference in compact little depth-of-focus charts which show at a glance the depth of critical focus before and beyond objects at given distances, with lenses of different focal length, working at various apertures.

In making a photograph of a structural element at, say, 15 feet, with the diaphragm of a 5 5/16-inch lens set at f:6.3, the depth-of-focus table will tell one immediately that from such a combination one may expect sharp focus from 12 feet, 11 inches to 17 feet, 10 inches, while for the same lens reduced to f:16 these distances will be 10 feet, 9 inches to 24 feet, 10 inches.

In survey photography many subjects are met with in which the principal object desired is closer than Infinity distance, while others almost equally important extend far beyond the limits imposed by the depth of focus rule. An example of this would be a structural element at 15 feet from the lens, with desired contributing elements 100 feet or so beyond. The difficulty is easily overcome, for the Infinity point may be brought nearer than normal by establishing a hyperfocal point beginning at half its distance before the object and extending far beyond.

While in theory such a thing as fixed focus is an impossibility, every lens aperture has its hyperfocal distance, beyond which all objects will be sufficiently sharp for practical purposes. This distance may be determined either by ground glass or focusing scale. With hand-held cameras it may be worked out by a simple formula: the diameter of the aperture desired multiplied by the focal length of the lens and the product divided by 100 for average detail, or 200 if extremely critical definition is required. To the quotient is added the focal length, the sum being the exact distance of the object upon which the lens must be accurately focused to insure far and near sharpness. Handy little tables have been prepared which give all this information at a glance. Their advantages are obvious, when one realizes that with our little camera of 4¼-inch focal length opened at f:5.6 aperture and focusing scale set at 27 feet, everything wished for in the negative will be secured from 13½ feet on.

Judging Exposure. There should be no guesswork as to exposure where a variety of subjects under different light conditions are encountered. Even the experienced professional photographer is often puzzled in determining just how much or how little light of photographic quality he has to deal with. Time of year, atmospheric haze, color, nearness of objects, absorption of light by surrounding objects, and reflected light are all factors having direct bearing upon correct timing. It is also important that the exposure calculation be based upon the light reflected by the object itself and not by surrounding objects.

A Long Range Shot at 1/50 Second Proving That a 2¼ x 3¼-inch Negative Can Record the Facts

There are several types of exposure meters which make possible quick and accurate calculations. These may be roughly classified as: (1) card meters, which give close approximations of the light and subjects present, with proper exposures given for full range of apertures and shutter settings; and (2) extinction meters, which are sighted directly upon the object and manipulated until the light admitted by the eyepiece is reduced to proper exposure point, readings being taken from the instrument. My own preference is for either a "Diaphot" or a "Justophot," both of which are of the extinction type. The former is quite inexpensive, handy in size, and once its extinction point is understood, it will be found dependable for interior or exterior use. The Justophot is more precise in its calculations, eliminating all chance of error, no matter how difficult the subject or its lighting.

Whatever means are employed in figuring out exposure, it is well to bear in mind the axiom: "Expose for the shadows, and let the high lights take care of themselves." If after detail, one

must be sure to time the shot to get it on the negative. The emulsions of modern films and plates provide a surprising latitude in the matter of exposure; so it is better to err on the side of too much time rather than too little.

Distance gauging is not likely to be a great problem to men experienced in making rapid approximation of measurements. It is nevertheless well to be provided with a dependable range finder for close-ups that require critical definition. There are several types which give most satisfactory results,—compact little instruments not much larger than a cigarette lighter, requiring but rapid sighting and a finger and thumb turn of a calibrated dial to obtain readings of from 4 to 100 feet. A range finder will also be found quite valuable in making distance approximations where a tape is not available or practicable.

The Camera. And now for a brief consideration of the camera itself with which to make good survey photographs. Compactness, completeness, and ease of manipulation are equally important. After experience with various makes and types, my choice has settled upon the little camera here shown. It has everything and more to be desired by the architect, engineer or structural supervisor. Closed, its outside dimensions are but 7 x 3½ x 1½ inches. It weighs a trifle more than a pound, and its capabilities and adaptability extend to the most complicated forms of visual survey making. It is, of course, equipped with the f:4.5 Tessar lens and the Compur shutter already described. With these are included several features which make immediate appeal. The foremost perhaps is the "Iconometer" focusing frame, which swings out from and moves with the lens and shutter assembly. Through it the operator may view and compose his picture at architectural eye level, or standing point, up to and through the instant of exposure. There is also a brilliant reflecting finder adjustable to vertical and horizontal views, but on survey work the Iconometer will be much more frequently called into play. In fact, many a sharply-angled downward slant, over a scaffold's edge or into an excavation, would be next to impossible without it.

The rising front of this little camera is also of considerable importance. A simple finger and thumb control raises and lowers the lens and shutter assembly at will, increasing or decreasing the amount of foreground and helping to obviate distortion caused by tilting the camera. The hooded focusing back attachment, double extension of bellows, convertibility to roll film, film pack, cut film or plate, and adaptability to wide-angle and telephoto work through the use of supplementary lenses, are other features seldom found in a camera of such small size.

What the average "snapshotter" usually considers to be poor lighting is often an advantage to the survey photographer. As a matter of fact, I try when possible for a slightly overcast day on work requiring exterior views of construction. Brilliant sunshine may be fine for simple record pictures or contrasty pictorial effects, but with structural elements it is quite another matter. "Expose for the shadows and let the high lights take care of themselves," but, as with all rules, this rule has its exceptions. To pierce the inky blackness cast by glittering sunlight upon a complicated structural detail half in and half out of shadows, and to expect a satisfying approximation of correct values, is asking too much of even the long-range emulsions found in modern films and plates. One will get one or the other, depending upon which one has time for, but there is small chance of getting both with the even balance of detail a good visual survey should have. Slightly overcast skies help matters mightily, and if one has the right sort of lens and shutter combination, there need be no worry about getting a good exposure on a bad day, provided it be at effective shutter speed.

Wide Angle and Telephoto Work. There are times when even an f:4.5 lens must have assistance. I speak particularly in reference to subjects which require a much wider angle of view than is made possible with the Tessar used alone. For this, a little wide-angle attachment becomes a very welcome accessory. It is slipped over the mount of the Tessar, shortening the focal length considerably and widening the angle of view in a most satisfactory manner. In such cases use of the ground glass becomes necessary, but this is made easy by the focusing back of the little camera just described. Supplementary lenses for telephoto work may also be used, making possible close-ups of distant and semi-distant objects which could be had in no other way.

A good filter should be part of the survey photo fitted kit. This, too, is slipped over the regular lens. Filter action slows up the ultra-violet rays which normally register far ahead of colors farther down the spectrum. Used in connection with panchromatic plates or films, a filter brings out reds and yellows which otherwise would be expressed in tones far darker than the originals. Used with ordinary films or film packs,—which now possess a high degree of color perception,—a light yellow filter will do much toward snapping out the contrasts of surfaces on which there is an abundance of reds and yellows. A filter increases exposure in ratio to its factor; that is, a 5-time filter lengthens normal exposure by just that many times; and except under the most brilliant light conditions, with lens at wide apertures, it is seldom feasible to use a filter without a tripod or other fixed support. A tripod should be carried.

CHOOSING THE STRUCTURAL SYSTEM AND MATERIAL

PART III—FLOORS AND ROOFS

BY

THEODORE CRANE

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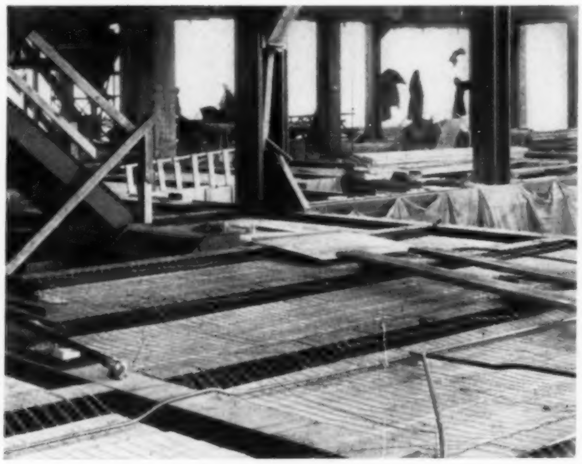
ONE of the most important problems facing the designer of fire-resistant buildings is the choice of the floor construction to meet the particular requirements of his project. It is not the intention of this article to describe all of the various systems that have been devised, but rather to deal with the special characteristics of those most widely accepted, and to point out their respective advantages and limitations.

Let us consider the problem at the moment when the architect's preliminary sketches have been approved and it is necessary to determine the structural design of the floors and roof. We can safely assume that the location and type of occupancy are known. The general dimensions of the building, the lengths of the spans and the proportions of the bays, are evident from the preliminary drawings. The locality determines the building ordinance which must be adhered to, or the architect develops his own standard for the structural design, based on his knowledge of what constitutes good practice.

In the larger buildings the first step in structural design is to make a tentative choice between a reinforced concrete and a steel frame. This is important, since some floor systems are not suited to both. Even if the building is a low structure with bearing walls, the framing of the interior will be of either of some form of steel or reinforced concrete, except in rare instances where bearing partitions may be used. If steel is employed, there are a number of floor systems covering a wide range of applicability. Prominent among these, in the east, is the so-called "cinder arch," which has been used extensively in New York. The present municipal ordinance covering this system went into effect about 13 years ago, and it permits 4-inch cinder concrete slabs, properly reinforced, to be used in fire-resistant buildings for clear spans of up to 8 feet. As a 16-foot column spacing would be too close for economy, and as furthermore it would result in placing a concentration on the center of the girder, the almost universal practice is to space columns up to 24 feet and to bring the beams onto the girders at the third points. This system is particularly economical in New York, where neither the code nor department ruling has placed any limiting value on the load per square foot that may be carried by a 4-inch slab, provided that the sectional area of steel reinforcement meets the requirement of the empirical formula. General practice would seem to allow anything up to about 300 pounds per square foot, which is the sidewalk requirement. The concrete functions principally as a stiffener for the suspended mesh.

Cinder Concrete. To what extent we are justified in the structural use of cinder concrete depends upon the character of the materials, workmanship and exposure. Good work can be done with clean, anthracite cinders, and there is no evidence that the reinforcement corrodes in dry locations. Unfortunately, much of the cinder concrete now being placed, on even large structures, is neither well mixed nor thoroughly compacted. Furthermore, the structural slab is often screeded off level with the top flanges of the steel beams, which practice permits the cinder fill to come into direct contact with the wire reinforcement which, of course, passes over these supports. Presuming that a well proportioned cinder concrete offers some protection against corrosion, it would seem desirable to raise the slab sufficiently to give at least a 1-inch thickness over the metal. Aside from these criticisms, however, and the propriety of using cinder concrete in buildings referred to by their owners as "monumental," it is a type of construction which has undoubtedly proved both economical and satisfactory with steel frames. But it should be remembered that in cities such as New York, where many firms of subcontractors have specialized in laying "floor arches," the price per square foot is much less than could be expected in many localities.

Ribbed Floor Systems. Whereas the use of cinder concrete is principally confined to certain large centers, various types of ribbed floor construction are widely used throughout the country. These originally developed from the solid concrete slab by the simple expedient of replacing the concrete in the lower portion of the slab with fillers, such as terra cotta or gypsum block, or by framing voids with wood or metal pans. As this portion of the slab, being below the neutral surface, carries no compression except over supports, it is quite practical to concentrate the reinforcement in ribs spaced from 16 inches up to several feet on centers, and to design the latter of sufficient width to properly enclose the steel and provide for shearing stresses. The advantage of this method lies in the reduced dead load. For example, a solid concrete slab 10 inches thick would weigh 120 pounds per square foot; the same thickness, with 8-inch gypsum block fillers and a

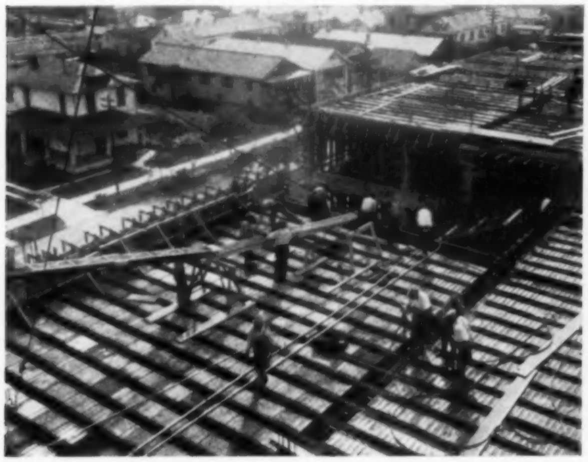


Wire Fabric in Place for the 4-inch Cinder Concrete "Arches" on an Office Building in New York

Concrete Rib Construction with Gypsum Block Used As Fillers on a Building in Baltimore

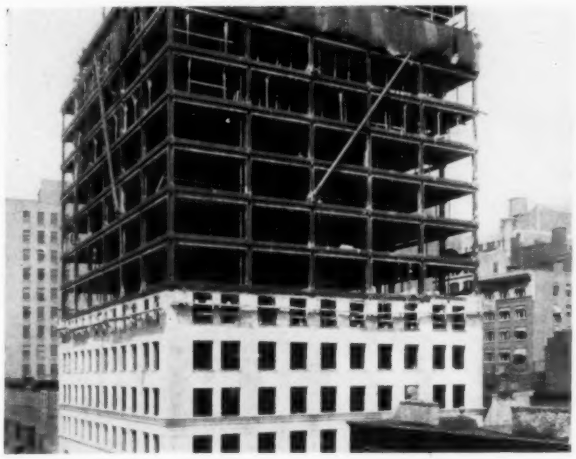
2-inch "topping," would weigh 60 pounds. If it is desired to use a metal lath as a base for ceiling plaster, the metal or wood pans show even greater saving in weight, giving a floor load of only about 50 pounds for the same thickness. On multi-story buildings this is a very important matter, as the entire frame, including the footings, can be made correspondingly lighter. This type of floor can be used to advantage with either a structural steel or reinforced concrete frame, and it is particularly suited to comparatively light live loads, ranging from 40 to 90 pounds per square foot, and to long spans of from 18 to 28 feet.

It is futile to make general statements as to the comparative values of the various ribbed systems. From the structural designer's viewpoint, they all have the same characteristics. Ribs, 4 or 5 inches wide, are placed between filler blocks or pans and computed as small, individual T-beams. Many architects consider that the advantage of plastering upon a gypsum or terra cotta surface amply justifies the somewhat greater cost of the block systems, but metal pans are widely and successfully used in all parts of the country. These latter are referred to as of the "removable" or the "permanent" type, depending upon whether they are taken out and re-used or left in place. The reinforcement of the ribs or joists, as they are sometimes called, consists of one or two rods or bars, alternate rods being raised at about the fifth points of continuous spans to resist the tendency of the beam to fail in shear, or more correctly, in diagonal tension. Where light concentrations occur, such as under terra cotta partitions, joists of double width and with twice the typical reinforcement are employed; a "bridging joist" is used near the middle of long spans to give lateral support. It is usually possible to avoid the use of stirrups, as most building codes follow good practice in allowing 60 pounds per square inch in

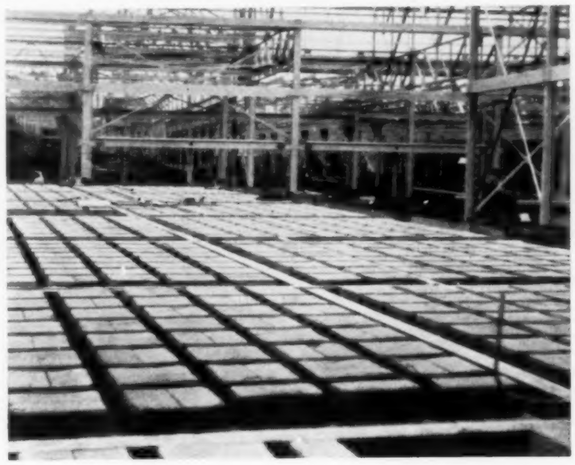


Metal Tile or Permanent "Tin Pans" Ready for the Pouring of the Concrete on a School Building in New Orleans

Removable Pans in Place on a San Francisco Garage; a "Bridging Joist" is Provided Along the Center Line of the Span



Type of Framing Suited to a Two-way Floor System. Necarsulmer & Lehlbach, Architects



Two-way System Formed with Structural Fillers of Slag Concrete; the Panels are Practically Square

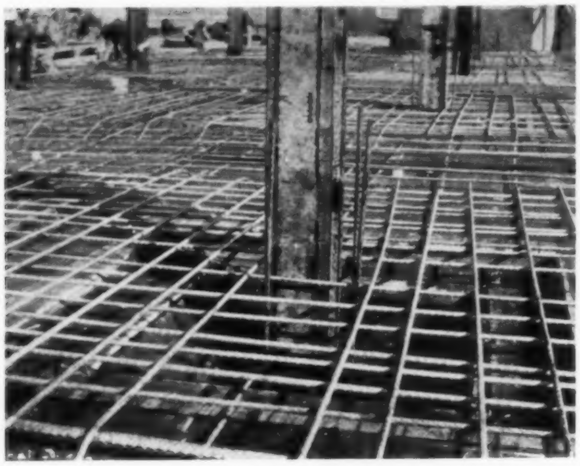
vertical shear where the longitudinal reinforcement is properly anchored. If the shearing stresses are critical, or if the requirements for negative bending moment over continuous supports demand a larger section adjacent to supporting members, it is possible to obtain tapered pans, the use of which results in flaring the ribs. If the design actually requires stirrups, the "continuous" type is probably the more economical.

Over the tops of the terra cotta or gypsum fillers, as well as where metal or wood pans are used, it is customary to place a thin slab of concrete cast integrally with the ribs. The thickness of the slab, referred to as the "topping," is generally specified by code as not less than 2 or 2½ inches. Where the lower limit is sufficient over terra cotta or gypsum block, it would seem desirable to have at least 2½ inches over pan construction. Building ordinances do not usually make this differentiation. Reinforcement, in the form of small rods or wire fabric, is placed in the topping in order to carry the load to the joists and strengthen the slab against stresses due to volumetric changes or impact. The pan systems are particularly adapted to buildings where hung ceilings are necessary in order to provide for ducts.

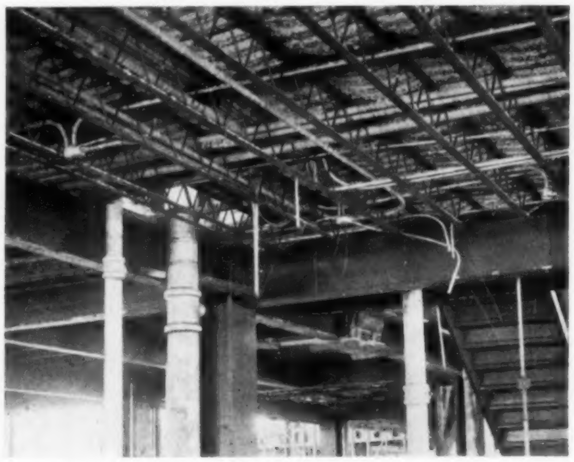
Two-way Systems. Ribbed floors designed as two-way systems, that is with concrete joists running in two directions, constitute an extremely interesting part of this subject. The steel dome is the two-way application of the principle of the metal pan. The two-way system employing precast concrete or terra cotta blocks between the joists is well known. These are both proprietary designs but have been widely used and with excellent results when the plan of the building and partition arrangement is appropriate for a two-way distribution. Taking advantage of the principles underlying the design of flat plates, which have been studied by many investigators both in this

Typical Reinforced Concrete Beam-and-slab Construction as Designed for a New York Post Office. A. S. Alschuler, Architect

Typical Reinforced Concrete Girderless Floor Construction with Drops Over Columns and Half Drops at Walls. Cass Gilbert, Architect



Typical Arrangement of Reinforcement for the Two-way System of Girderless Construction; the Steel Column Cores Are Used Only Through the Lower Stories of This Warehouse



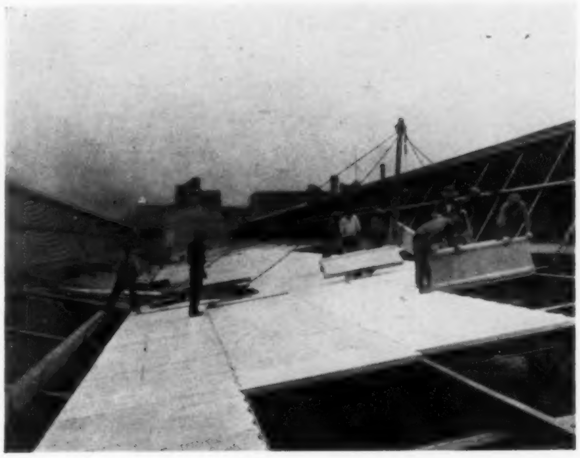
Typical Light Construction of Pittsburgh Office Building, Showing Pipes Passing Through the Joists and Concrete Carried by Metal Fabric. Joists Are Doubled Under Light Concentrations

country and abroad, the owners of these systems have gained the approvals of many building departments, and among them those of our largest cities, for the use of empirical coefficients in the moment computations. In the past it has been the practice to compute the sustaining power of a concrete slab of two-way design as if it consisted of a series of parallel beams, entirely neglecting the strength due to "plate action." In the light of both theoretical analyses and practical tests, it would appear justifiable to use moment coefficients on two-way designs 30 per cent less than those that would be applied to individual beams under similar conditions of restraint. In other words, the bending moments on all two-way slabs, of both solid and ribbed construction, might well be approximated as $\frac{WL}{12}$, $\frac{WL}{15}$ and $\frac{WL}{18}$ instead of as $\frac{WL}{8}$, $\frac{WL}{10}$ and $\frac{WL}{12}$ in which W=total load per lineal foot carried in the direction of the reinforcement under design, and L = span as ordinarily defined. As a general principle, it may be borne in mind that when a building can be framed to obtain approximately square bays, with supporting girders or walls on all four sides, there may be a distinct saving in using a two-way system. It can be employed with either bearing walls, steel or concrete frames and have a wide range of application, being suitable for all loads up to those ordinarily used on the floors of buildings intended for light manufacturing purposes.

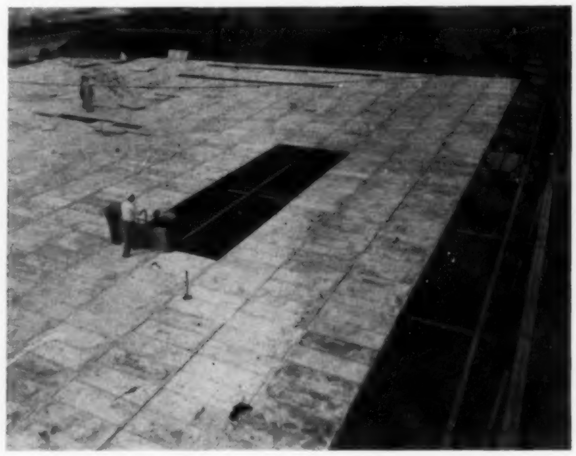
Light Weight Rolled Steel Sections Used with a Structural Steel Frame

A comparatively new system employing slag block units between concrete ribs, running in two directions, furnishes an economical design falling under this classification. The blocks are made of Portland cement, sand and slag; owing to their strength and comparative lightness, they serve in a structural capacity as well as acting as fillers. A topping of concrete is not necessarily required, but it may be used to give the exact thickness called for by the design. This system is adaptable to either a structural steel or reinforced concrete frame and is particularly economical for light and medium loads. During this year it is being installed in several of the largest hotels in New York.

Beam and Slab. The first type of reinforced concrete floor construction that came into use for other than extremely short spans is known as the "beam and slab." In the typical arrangement, columns are placed on about 20-foot centers; girders run between columns in one direction, usually across the building, and the beams frame into the girders at the third points of their spans. An industrial building designed for a live load of 200 pounds per square foot with bays 20 feet square, would require, approximately, a 4-inch thickness for slabs, supported by beams and girders 8 by 20 inches and 12 by 28 inches, respectively. The depths are taken from the top of the



Pre-cast Concrete Channel Slabs Being Placed Over a Structural Steel Frame on a Detroit Factory



A Large Roof Area of Pre-cast Concrete Slabs Laid Over Railroad Yards in Hoboken

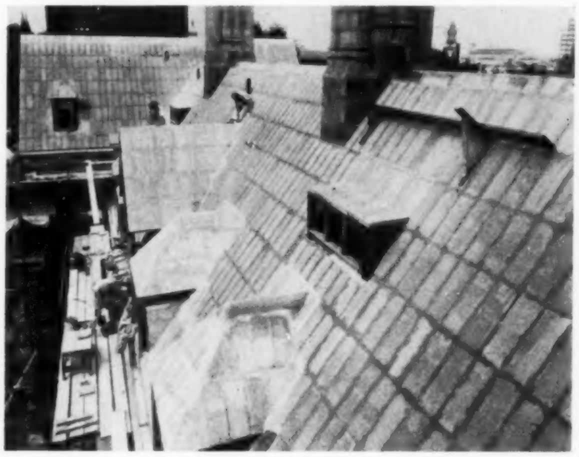
slab. This system is still used for floors built of solid concrete, the arrangement of which does not lend itself to the generally more economical design known as "girderless construction." Obviously, such a system can be adapted only to a concrete frame.

Girderless System. Within recent years beam-and-slab designs have been largely superseded by the girderless type wherever the size of the building and the interior arrangement permit three or more consecutive bays in each direction, provided that the bays are approximately square and of about the same size. This system, however, is not usually economical for live loads of under 100 pounds per square foot, and its particular function is use for industrial buildings and warehouses with live loads ranging from 125 to 300 pounds per square foot of floor area. For the loads ordinarily used in apartment house construction, a pan or ribbed design is more desirable from the viewpoint of structural economy, entirely aside from the architectural difficulty presented by the flared column heads. For industrial buildings designed for a live load of 200 pounds per square foot, and employing drop panels over the columns, the sizes of structural members for a bay 20 feet square would be approximately an 8-inch thickness for the slab; drop panels 6 feet, 8 inches square and projecting 3 inches below the soffit of the slab; column capitals 4 feet, 6 inches in diameter. These dimensions would conform to the requirements of most cities, including New York and Chicago. The girderless system can be used to advantage with either a reinforced concrete frame, which is the usual construction for comparatively low industrial buildings, or with structural steel column cores, which have recently become popular for comparatively tall city buildings.

Light Steel Joists. Passing from the class of heavy concrete construction to that of the lighter sections, we have various types of pressed and rolled steel joists. These are not used to advantage with a concrete frame, and although capable of carrying light manufacturing loads on comparatively short spans, are particularly suited to designs requiring live loads of from 40 pounds to 75 pounds per square foot. Pressed metal joists have been on the market for many years and are used in exactly the same way as wooden joists, except at a somewhat greater spacing, and usually as supports for a 2-inch concrete sub-floor poured on metal lath or similar construction. Recently, the new "light steel joists," which are actually light trusses, have been developed and widely used. This construction is extremely simple, the ends of the joists resting on supporting walls, or steel girders and the upper chords carrying the structural slab which may be of either concrete or gypsum, cast over metal reinforcement. As the joists are of open design, it is possible to conceal pipes within the floor. The plaster of the ceilings is applied to metal lath attached to the lower chords of the joists. The latter are occasionally

Pre-cast Gypsum Floor and Ceiling Blocks Used with Light Weight Rolled Steel Sections

Gypsum Tile Being Placed Over a Structural Steel Frame on a College Building in Illinois



Short Span Gypsum Tile Laid Over a Structural Steel Frame on a Dormitory for Yale University

spot-welded to the upper flanges of the girders, and wire bridging is used to give lateral stiffness. Sometimes more lateral support may be required.

To fill the demand for a strong and rigid floor, yet one of lighter weight than would be obtained with standard sections, there have recently been placed upon the market light weight rolled steel beams which are normally set from 2 to 4 feet apart and used to support slabs of either concrete or gypsum. The latter may be in the form of pre-cast units or poured in place, reinforced with metal lath or mesh. These systems are generally used with structural steel frames, but are also suitable for floors supported by bearing walls.

Non-fireproof Framing. Owing probably to its obvious simplicity, framing the interiors of non-fireproof buildings, having exterior masonry walls, is a subject that has received very little attention. In fact, one often sees wooden posts and girders used in residence construction, with the result that the natural shrinkage of the wood causes the interior of the building to settle appreciably. To minimize this difficulty cast iron columns filled with concrete should be used in place of wooden posts, as the increased cost is negligible. For the main girders, carried by the columns, H-sections with square flanges should be employed for the support of the wooden floor joists. The standard I-beam sections are not very satisfactory, since the lower flange does not give adequate bearing and necessitates either bolting a carrying ledger to the beam, which is somewhat awkward, or the loss of headroom resulting from allowing the joists to rest on the tops of the steel girders, instead of framing into them. The studding of main partitions should, of course, rest directly on the upper flanges of the girders and not upon the joists comprising the floor system. The sizes of wooden floor joists and the requirements for anchorage, or coping and bridging, are of such general knowledge that the subject will not be further treated in these articles.

Fire-resistant Roofs. The design and construction of fire-resistant roofs is a subject that has received considerable study during recent years. It is not a simple matter to build pitched roofs that will satisfy both structural and architectural demands and at the same time be practically fireproof. In ancient and mediæval buildings use of the wooden truss was the only alternative when the architectural treatment made impracticable the employment of vault or dome. Modern practice, however, demands that our monumental buildings be roofed with something more fire-resistant than lead-covered timber frames, and the result has been the employment of structural steel and reinforced concrete. Some years ago there was much talk of building with pre-cast concrete units. This system was actually applied to the walls of a few moderate-sized structures for which large slabs were cast upon the ground and raised into place by means of jacks. Twenty years ago the author worked as assistant superintendent on a large concrete residence, the pitched roof of which was built in this manner. Ridge and rafters were cast in place, after which large concrete slabs were raised from the ground by means of a gin-pole and dropped in place on the supporting members. It is quite possible, with proper care in detailing, to make a satisfactory weathertight and fire-resistant roof in this way, but it cannot be recommended as economical, nor would the concrete surfaces, even when colored, be architecturally acceptable in most cases.

At the present time, structural steel of standard or special sections would seem to be the most desirable for the supporting members of pitched roofs. Welded connections have been found satisfactory, particularly where electric welding was practicable. This method was successfully em-

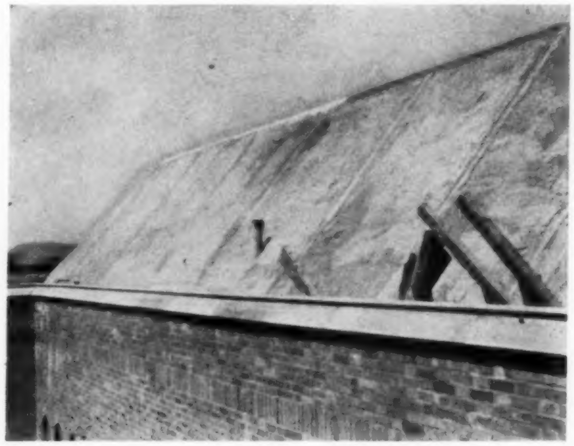
Gypsum Poured in Place Over a Thin Sheet of Compressed Gypsum Formed This Roof Surface

A Steel Deck Being Laid Over a Structural Steel Frame On An Ohio Factory

ployed for the purpose of attaching the purlins to the rafters, on the steel framed roof of a large dormitory recently built at one of our eastern universities. Several materials, or rather systems, can be used over the steel. For industrial buildings, pre-cast concrete slabs offer a satisfactory surfacing but are not practical as a base for slate or tile. It is also possible to employ terra cotta "book blocks" laid between steel purlins, or pre-cast gypsum blocks. The steel of the roof should be designed to meet the special requirements of the system. These methods are particularly suitable for large roof areas which are not too complicated in design. If gypsum is employed, it is necessary to give the blocks a waterproof coating as soon as laid in order to protect them from moisture before the application of the surfacing material. The individual slabs should be securely anchored to the steel purlins and the joints filled with a gypsum mortar. Another very satisfactory method, which has been successfully applied to the roofs of monumental buildings, is the use of cinder concrete slabs cast in place over the structural steel framing. There is also a choice of various other materials, including gypsum and mixtures containing Portland cement combined with certain light weight aggregates which are suitable for roof work and are placed in a plastic state. When hardened, the cinder or composition slab is coated with a 2-inch layer of a proprietary material, applied like cement mortar, which serves to receive the nails holding the slate or tile in place.

Flat Roofs. A flat or slightly pitched roof offers no particular structural problem. In this case the designer's attention must rather be centered upon making the deck waterproof. The numerous offsets introduced by our so-called "set-back" laws, applying in all of the larger cities, have become the rule rather than the exception and are taken care of as a matter of course by the engineer or structural designer. The problem of waterproofing, however, is more often slighted. Specifications seldom fail to properly describe the typical work, but the details of flashings and the proper use of suitable mastics as joint fillers are too often left to the devices of the subcontractor.

Volumetric Changes. In this work, as well as in all else concerned with building construction, it is essential to realize that volumetric changes due to variations in temperature and moisture actually cause appreciable movement in our structures. The hair cracks which are characteristic of concrete and stucco surfaces, when used continuously over an extended area, usually have their counterpart in the joints of brick, terra cotta, natural and artificial stone. If the work is well done, the cracks are too small to cause trouble on unrestrained surfaces; they express what might be called the "respiration" of the building and are hardly more serious than the very measurable lengthening of large concrete structures under the heat of the sun. But the unit, or assembly, as the case may be, must be free to move, or something will break. An actual instance is on record of a cinder concrete roof filling having expanded with sufficient force to shear off a parapet post somewhat over a foot square in horizontal section and reinforced with four ¾-inch rods. Good construction provides a mastic filled joint where materials are capable of expansion about parapets, chimneys or penthouse walls. This has become an established practice. Difficulty arises from much more subtle causes, among which is the contraction of the fluid concrete in the process of hardening. Provision should be made to permit the initial contraction of the concrete without rupture, and the work should be designed to allow each unit freedom to swell and contract with climatic changes which are certain to occur.



These Two Views Illustrate the Use of Reinforced Cinder Concrete Supported by a Structural Steel Frame. At the Right the Concrete Has Been Covered by a 2-inch Thickness of Nailing Material

In most cases it is a mistake to cast long sections of concrete monolithically. The amount of reinforcement used in our industrial buildings, or others with reinforced concrete frames, tends to hold the mass together and to distribute the strains due to secondary stresses, but even for such structures it is desirable to limit the lengths between joints to 300 feet. A complete separation is then made between the two parts; double columns are constructed on the exterior, and the floor slabs are built as cantilevers on each side of a transverse joint, passing entirely across the building from the top of the footings to the roof, where the parapet and roof slab are also divided. Retaining walls, particularly those used in landscape work, often show signs of disintegration or develop serious cracks after only a few years' exposure. Although there are usually contributary causes, most difficulty is due to two factors,—faulty design in not providing properly for volumetric changes, and faulty construction which results in porous concrete. Both of these evils are preventable, and we all know that excellent results can be obtained in concrete if the work is properly designed and conscientiously built. It is an extremely simple matter to divide parapets and retaining walls into sections by introducing joints at the posts or pilasters. If such are made effective by the use of some material which prevents the adhesion of the two surfaces and gives a slight cushion, no difficulty will be experienced.

Terraces, etc. Similarly, the floors of exposed terraces must be given a chance to expand and contract. Sidewalks supported upon soil are generally cut through on 4- to 6-foot centers, which is satisfactory under normal conditions without any joint filler. The surfacing of exposed terraces, however, often requires carefully designed jointing to provide for temperature variations. Specifications normally call for a membrane seal beneath the tile or concrete wearing surfaces of loggias and exposed roof decks. Equal attention should be paid to the character of the mastic used to fill the expansion joints. Overflow due to expansion may be controlled by not filling the joints quite full, but there are few materials that will follow the receding masonry when the joint is broadened by contraction.

The method of obtaining a suitable grade over large areas of so-called "flat" roofs is another subject that deserves consideration. The simplest solution, and one often applied, is to lay the structural slab absolutely level and to obtain drainage by the use of cinder filling. This, however, increases the dead load, and where feasible it is better to pitch the roof slab itself. Of course there is no real objection to having an absolutely level roof surface, as the same guarantee can be obtained from the roofers, but if it is desirable to avoid pools of water remaining after rainy periods, a slight pitch is essential. It is usually practicable to work out a suitable grade in connection with the insulation of the roof, which becomes an important matter where conditions are likely to produce condensation. The steel roof deck, a type of covering which is extremely economical, and well adapted to certain types of buildings, presents a real problem in relation to insulation. Although furnishing a perfect base for the application of membrane roofing, ½ inch of fibrous insulation board is inadequate to prevent heavy condensation on the under side of the metal. It would seem desirable to provide thorough ventilation beneath all such installations.

NOTE. The author wishes to acknowledge his indebtedness to these firms and associations for the use of the photographs used as illustrations: American Steel & Wire Co.; United States Gypsum Co.; Truscon Steel Co.; Republic Fireproofing Co.; Barney-Ahlers Corporation; Jones & Laughlin Steel Corp.; Federal Cement Tile Co.; American Cement Tile Co.; Marc Eidlitz & Sons, Inc.

WALL STREET ENTERS THE BUILDING FIELD—II

BY

JOHN TAYLOR BOYD, JR.

THE preceding article, in THE FORUM for May, dealt with recent developments in construction finance, quite revolutionary in themselves and in their possible effect on the building industry. Introduced into the New York building world by several large corporations, with the strongest Wall Street financial support, they indicate a decided trend toward the efficiency of large scale operation. In this article there are discussed three specific financial plans illustrating the new methods. The plans are those of the Fred F. French Company, the Henry Mandel Associates, and the plan of the new triple combination of the Beaux-Arts Development Corporation,—a syndicate headed by a group of prominent architects with the huge U. S. Realty & Improvement Corporation, and the National City Bank, now the third largest bank in the world.

As explained in the former article, the principles of this method of financing, which is novel to the building industry but not outside it, are chiefly: (1) Investment value, as compared with the speculative element which characterizes too much conventional real estate finance. (2) Sale to the public of long term security issues at low rates for both junior and equity financing, involving the entrance of the public into ownership purchase of common stock of real estate.

These three financial plans are presented solely as illustrations of the new ideas of building finance. No attempt is made to select any one plan as the best. That is impossible, because the financial plan of a building varies in each case as does its architectural plan. Furthermore, any financial plan should be judged from these different viewpoints:

1. Of the construction corporation, seeking a steady supply of fresh capital at low rates.

2. Of the banking house whose aid is enlisted to market security issues directly to the huge public, composed of some 17,000,000 investors and speculators scattered all over the country. The securities sold must be sound and attractively priced in order to sell in competition with the flood of security issues of all types.

3. Of the individual investor, who selects his securities from among the myriad of offerings, according to his personal needs and preferences.

4. Of the building industry, to which the need is vital of obtaining for its expansion a constant flow of fresh capital at low rates.

5. Of the welfare of the American economic structure, which depends to a large extent upon the prosperity of the whole construction industry.

The financial plan of the Fred F. French Company is the first to be considered here. This is because this plan is well understood, having been in operation for a number of years and having been extensively advertised to the public. In the "French plan" the point of departure from conventional methods rests in its financing of that remainder of the cost of the completed building above the first mortgage of approximately 50 per cent by means of the sale of long term security issues directly to the public, using its own permanent sales force. In this way, the French Company obtains a never-ending stream of millions of dollars of new capital for its colossal building program, at presumably a much lower cost than it would if it used the ordinary methods of either mortgage bond issues or long term first and short term junior mortgages, both of which involve seeking equity from wealthy speculators.

In the French plan, the public takes on an actual ownership share in the individual building, with the opportunity of sharing in prospective profits in (1) increased land values, (2) increase in equity as mortgage is amortized, and (3) in prospective earnings and dividends. The investor's position is different from that of the purchaser of the conventional mortgage bond, who is a creditor and whose return is limited. The owner of stock in a French Company building depends for the soundness of his investment on these factors: (1) The success of the French Company's management, (2) the large proportion of equity, equal to approximately one-half of total cost, and (3) the economy and safety of the long term system of financing of junior and equity finance, under which both profits and repayment of junior financing are deferred for several years, until the earnings of the property are sufficient to carry the load. This advantage of long term financing was discussed in the earlier article. It was pointed out that it is (1) the terrific burden of heavy discounts, of premiums and high amortization rates on junior mortgages, and commissions of one sort or another,—often totaling 15 per cent or more,—and (2) the much higher cost of obtaining equity money, for which a big speculative profit must be shown "on paper," which break the back of many an intrinsically sound building enterprise. And, equally important to this financial load of short term issues, there may be charged the abandonment of many a good building enterprise, to the detriment of the construction industry.

The French plan bears two points of resem-

blance to the conventional method. One is its use of the conservative "institutional" first mortgage. In the ordinary French project the proportion of mortgage to total cost is, as already said, as near 50 per cent as practicable. The interest rate is usually 5 or 5½ per cent, and the mortgage is amortized. The second point of its resemblance to conventional methods is that the French plan does not directly give to the investing public the full benefit directly of diversified ownership in the chain of buildings, although the Company itself receives this protection of diversified risk. The typical French security issue is limited to a single building, which is incorporated as a separate company, with limited liabilities, as in the case of the usual mortgage bond issue which is not "guaranteed" by the house of issue. Thus the investor puts all his eggs into one basket. On the other hand, it should be pointed out that the investor may gain the protection of an investment in a chain of buildings by spreading his purchases over a number of French buildings. Incidentally, the investor has also the opportunity of buying the common stock of the "parent" Fred F. French Company, which is now traded in in the unlisted market in New York. This stock, which not so many years ago was "given away" as a bonus, recently sold at over $1,000 a share before its split-up. The French plan illustrates the great advantage of the long term method of junior financing. It would indicate that the customary division of financing into the long term first mortgage on the one hand and on the other the short term remainder of cost, is arbitrary, and has been carried to an illogical extreme. It runs up building costs and, in addition, it brings in its train a list of evils of excessive speculation.

The technical details of the French plan are interesting. The public buys preferred stock (6 per cent cumulative preferred, $100 par value) to the amount of about half the total cost of the operation, and with each share of this preferred stock the investor receives without further cost to him one share of common stock. For each share of common stock thus issued to the public, the Fred F. French Company receives one share of common as its profit. The result is that the investing public shares fifty-fifty with the French Company in the common stock ownership of the building, thus entitling it to half the profits. Profits accrue through retirement of the preferred stock, which is expected at the end of ten years in the average case. The retirement of the preferred is accomplished in ten equal payments of 10 per cent each, as the earnings permit, and no dividends can be paid on the common until all the preferred is paid off.

The Fred F. French Company performs all the operations that are necessary to produce a completed building,—buying the site, designing and constructing the building, selling the securities. In addition it operates the completed property through the Fred F. French Management Company. "Total cost" is the cost of land, construction, of carrying charges during construction, cost of selling securities, and of the normal fees paid to the Fred F. French Company for architecture, contracting, underwriting, for managing the building, and for the necessary advertising. I am informed that the usual underwriting fee is 5 per cent of the total cost of a French operation. This expense, be it noted, offsets somewhat the usual mortgage bond discount or charges for junior financing, but here again, in the French plan, the cost is spread over a period of years. The charge is not deducted at the beginning but instead is capitalized, and its payment is deferred.

When one has mastered the main points of the French plan, it is easy to understand the plan of the Henry Mandel Associates, which seems to be modeled along similar lines. The chief difference is that the Mandel plan gives the investing public the benefit of diversification through part ownership in a chain of properties, in addition to taking an interest in an individual structure. More specifically, the investor purchases "units" of stock at $110 per unit. The unit consists of one "investor's" share of $10 in the Henry Mandel Associates, the parent company, and one $100, 6 per cent convertible gold note in a single building. This gold note is convertible into 6 per cent cumulative preferred stock in the single building at the end of one year after completion of the structure, at the option of the holder, and, at the option of the company, in two years. The note matures in about ten years. Now, the investor's share of the common stock of the parent company, Henry Mandel Associates, is matched, share for share, and is paid for, dollar for dollar, by a "founder's" share, owned by Henry Mandel. In other words, Mr. Mandel invests in the common stock of the parent company owning the chain of properties, on the same basis as the public and to the same extent. Also, since the investors in the first buildings of the chain take a greater risk than those who invest in the later projects, when the success of this new enterprise has been presumably proved, these original investors will probably buy their common stock in the company owning the chain on a more favorable basis. In other words, the price of the investor's,—and of the founder's,—shares will doubtless be increased with each successive operation.

Other differences between the French and Mandel plans are (a) that the mortgage proportion of cost is about two-thirds in the Mandel plan, and (b) that the Henry Mandel Associates

makes public semi-annual financial statements of its own condition and of that of each of its buildings.

It should be pointed out that there is a theoretical limit to the expansion of the Mandel chain of buildings. That lies in the proviso that Henry Mandel himself invests dollar for dollar with the public in the parent company. Today there is no man in the world, nor any group of men, wealthy enough to go on indefinitely matching dollar for dollar with the American investing public. This is an era of mass-investment as well as of mass-production and mass-marketing. Everyone in Wall Street appreciates this fact but, curiously, the building industry has scarcely yet grasped it.

But to this point, this complicated discussion of building finance has failed to answer the real question at issue. That is the simple, homely question which the prospective investor asks the stock salesman: "How much, exactly, can I expect to get out of it?" That question is the crux of the situation for everyone concerned. To throw light on it, I quote from the pamphlet issued by the Henry Mandel Associates,—"Our Plan,—Your Opportunity." On page 26 is the table which gives the expected operation of the retirement of the preferred stock:

End of Year	Net Profits Per Share	Dividend Received	Preferred Stock Principal Repaid	Preferred Stock Principal Outstanding	Reserve
1st	$14	$6.00	....	$100	$8.00
2nd	14	6.00	$6	94	10.00
3rd	14	5.74	10	84	8.26
4th	14	5.04	10	74	7.22
5th	14	4.44	10	64	6.78
6th	14	3.84	12	52	4.94
7th	14	3.12	12	40	3.82
8th	14	2.40	13	27	2.42
9th	14	1.62	13	14	1.80
10th	14	.84	14	....	.96

Then, on the next page, it is said that after the preferred stock is retired, Henry Mandel Associates "will receive $14 per share per year for each share of common stock of the building. If it is assumed that a stock earning $6 per share is worth $100, then this income of $14 per share gives the common stock of the building a value of $233 a share." This is the stock for which the investors in the first building paid $10 ten years before, and received, meanwhile, no return on it, which adds to its cost at the end of ten years at say 6 per cent compound interest.

In Part IV of the same pamphlet, entitled "How Investors' Common Gains Value" is said: "Our experience has been that such buildings have a valuation on completion of upwards of 20 per cent above the cost of land and buildings, and that this increases after completion. Buildings are commonly sold at completion at profits of from 15 per cent to 50 per cent above cost." On "the conservative assumption that the property gains 20 per cent in value at completion, the common stock of the building gains (in the typical case illustrated) immediately a value of $50." This value "rises as the 6 per cent cumulative preferred stock is retired, with the result that, at the end of the retirement period, this common stock value per share will include the $100 which was the original cost of the preferred stock investment." Then it is said that "land in the areas (of Manhattan Island) where the Henry Mandel organization operates has a natural increase in value ranging from 3 per cent to 10 per cent annually. Assuming the lower figure, this increased land value represents a gain of $225 a year for each share of common stock of the building."

Office Building, New York, Financed on the Mandel Plan

Farrar & Watmough, Architects

The effect of these assumptions of increased value of the common stock is summarized in this table, copied from the pamphlet:

	Source of value	Number of Years after Completion of Building 1	5	10	15
(1)	Gain in value of building at completion....	$50.00	$50.00	$50.00	$50.00
(2)	Natural increase in land value..........	4.50	13.50	24.75	36.00
(3)	Retirement of preferred stock equity	....	36.00	100.00	100.00
	Total	$54.50	$99.50	$174.75	$186.00

These figures are, of course, estimates. No one can actually tell just what the exact financial position of the building will be in future years in respect to rentals, nor can one know exactly when obsolescence will set in, affecting the "economic life" of the property and its value. On the other hand, I believe that these mathematical computations of the *possibilities* of common stock ownership in real estate are well worth publishing, because they throw a new, clear light on the possible advantages of equity ownership in good real estate. That is an essential factor in real estate finance in these days when the investing public is seeking common stock ownership in basic American industries.

The plan of the Beaux-Arts Development Corporation-U. S. Realty & Improvement Company-National City Bank triangular combination, as illustrated in their first enterprise,—the $5,200,000 Beaux-Arts Apartments, Inc., located on East 44th Street, New York,—is more complex and is even more radical than the other two. The magnitude of the program contemplated, and the elimination of mortgages astonished New York, accustomed as it is to bold finance. This plan is not easy to describe. Kenneth M. Murchison, President of the Beaux-Arts Development Corporation,—the real estate promotion company composed chiefly of architects, discussed the plan frankly with me one morning.

The complication in the Beaux-Arts Apartments plan of finance centers in the involved interrelations of the three affiliated companies sponsoring the project. Between them, they perform about the same function as do the single French and Mandel organizations, in producing and operating a chain of buildings and selling securities to the public in the process, making investors part owners in the properties. Therefore, the picture clears if we imagine the triple combination taking the place of the French organization, and issuing securities, in the form of preferred and common shares, limited to a single building which is separately incorporated. That makes clearer the position of the investing public in the enterprise, and that, after all, is the point of this whole business. It is shown in this comparison, in which, in the Beaux-Arts plan, the three sponsoring companies are lumped together as "the Companies":

Division of Ownership in the Beaux-Arts Apartment Finances

	Total First Cost of Operation	Ownership of Common Stock (Profits)
Investing Public	75% consisting of 1st 6% preferred stock	40%
"Companies"	25% consisting of 2nd 6% preferred stock	60%

Division of Interests in the Fred F. French Plan

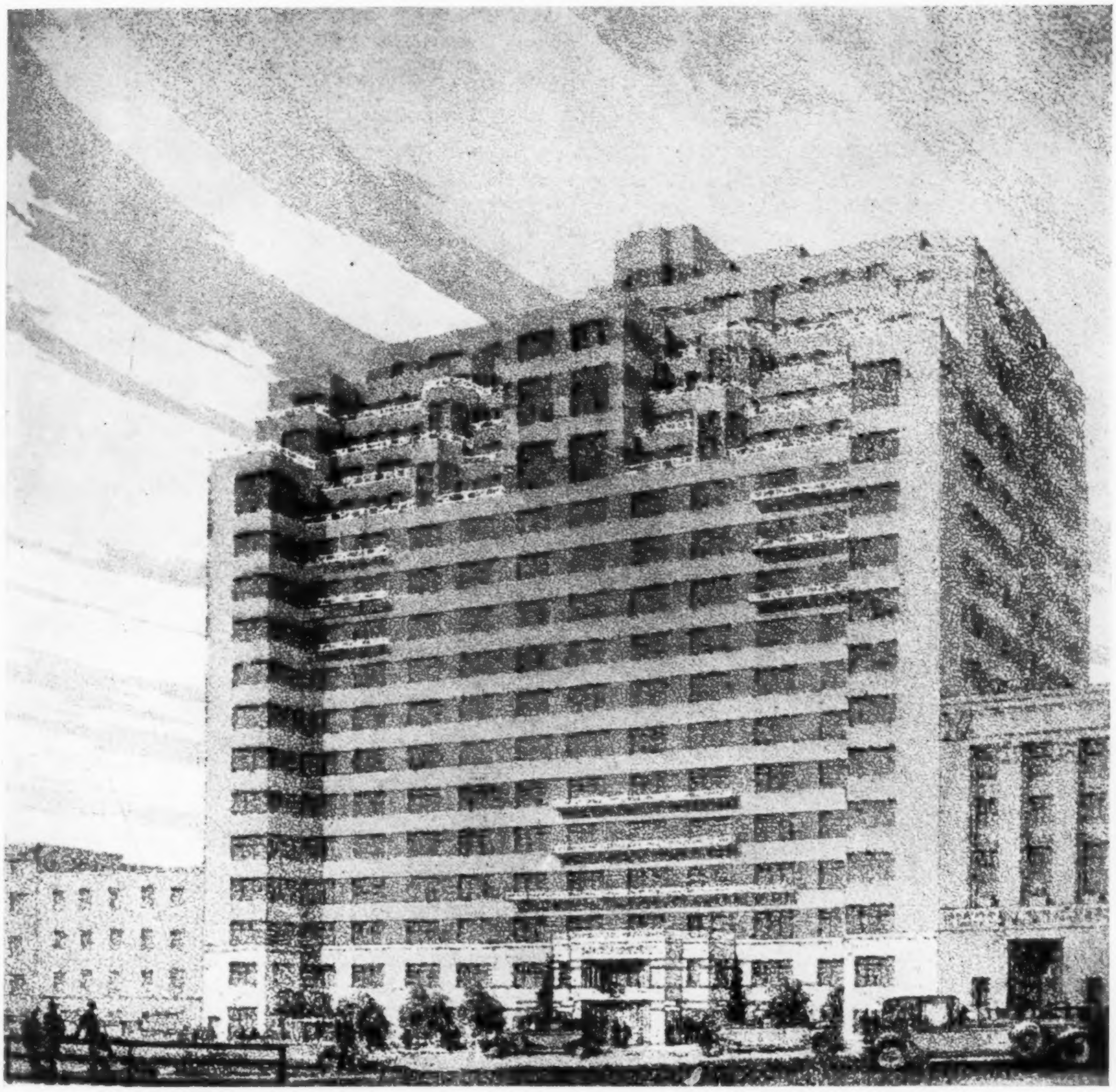
	Total First Cost of Operation	Ownership of Common
Mortgage Company	50% mortgage	0
Investing Public	50%—6% pf. stock	50%
French Company	0	50%

As compared with the conventional method, it is also apparent that, in the Beaux-Arts plan, the first preferred, bought by the public, takes the place of the usual two or three mortgages, and that the second preferred, contributed by the "Companies," takes the place of the usual equity. This arrangement puts the public in a very strong investment position. The investor cannot be "wiped out" by foreclosure. In fact, equally important, the consistent application of the principle of deferred profits protects that small proportion of junior mortgage risk which lies in his first preferred shares. Thus the soundness of the first preferred may be described by saying that about 85 per cent of it replaces a first mortgage (corresponding to the conservative 66 2/3 per cent first mortgage). The remaining 15 per cent contains a junior mortgage risk, or on the basis of a 60 per cent first mortgage, it represents an 80 per cent-20 per cent division.

The position of the public in the Beaux-Arts plan is completely explained when we understand the details of the retirement of the two series of preferred stock, and the possibilities of profit on their 40 per cent ownership in the common stock.

The first preferred is 6 per cent cumulative, retirable in whole or in part, at the "Companies'" option, at a price of $102.50 per share. It is sold with the common in "units" of one share of first preferred and one share of common, at $100 a unit. It is expected that one-third of the first preferred will be retirable in ten years (Mr. Murchison thinks it will be six), leaving the remainder outstanding to the amount of 50 per cent of total cost of the property. The second preferred, representing approximately another 25 per cent of cost, should be retired completely about three years later. At the end of this period, the common stock, which originally represented nothing but hopes of future profit, may have an equity behind it of about one-half the original cost. In addition, the full benefit of any appreciation in the property accrues to the common shares. Earnings on this common are expected to be $3 a share at the end of ten or a dozen years; if earnings permit, dividends may be paid on it before all the preferred is retired.

Comparing this $3 per share return on the Beaux-Arts Common with the $14 expected return on the Mandel common (which costs $10 a share), we see a large difference. The difference may be partly explained by the fact that the



Beaux-Arts Apartments, New York
Firm of Kenneth M. Murchison, and Raymond Hood, Godley & Fouilhoux, Architects

Mandel preferred shares represent a 33 1/3 per cent equity risk above the mortgage, whereas the Beaux-Arts first preferred is more nearly equivalent to a first mortgage risk. One might therefore conclude that the Beaux-Arts plan is designed to attract a more conservative class of investors.

It remains to describe the operation of the Beaux-Arts plan within the three companies and their subsidiaries. "The Companies," we have seen, provide the 25 per cent equity cost of the project in the form of second preferred, and take 60 per cent of the common shares as deferred profits. On the Beaux-Arts Development Corporation there falls the burden of taking the entire issue of second preferred stock. What actually happens is that the Development Corporation buys the site for the building and contributes it, at a fair value, to the enterprise, receiving in payment the second preferred shares. This is, of course, a form of the familiar subordination principle. The individual architect among the stockholders who has worked up the project receives the architectural commission on a basis of office cost plus fee, the fee being taken in stock. The next point is that the Development Corporation, having provided most of the equity, obtains most of the common stock profits, specifically approximately 40 per cent, or the same share as the public. That is, three shares of common go with one share of second preferred. That leaves 20 per cent of the common still to be accounted for. This is split half and half between the U. S. Realty & Improvement Corporation and the National City Bank. Actually, this 20 per cent of

common goes into the treasury of the U. S. Realty Management Corporation, which is a subsidiary formed to own and operate the chain of properties that it is proposed to establish. This U. S. Management Corporation is owned equally by U. S. Realty and the bank, through the latter's securities subsidiary, the National City Company. When we have said that both the National City and U. S. Realty have an interest in the Beaux-Arts Development Corporation, we have completed the description of the chain of relationships in the three affiliated companies.

The responsibility of the U. S. Realty in the organization is two-fold. First, it constructs the building through its subsidiary, the George A. Fuller Company, on a cost-plus fee contract. Second, it shares with the National City in financing and underwriting the project. The function of the National City is to share with U. S. Realty in underwriting and to sell the securities to the public through its vast chain of branches, representatives and agents, assisted by its powerful affiliated group of Wall Street investment houses. The underwriting was done at cost, the charge therefor being 5 per cent, plus 20 per cent of common profits as noted, thus deferring the financier's profits. This compares with an 11 per cent charge on a mortgage bond issue, which, however, is deducted at the start. This issue of units of first preferred and common, to the amount of $3,937,500, was sold to the public, so we are told, in one day.

One point more. The Beaux-Arts Development Corporation really represents the land interest, which, as everyone knows, is the crux of the situation in many a real estate project. Recognizing this fact, we have this division:

Division of Interests in the Beaux-Arts Apartments

	Investing Public	Land Owner (Beaux-Arts Develop. Corp.)	Construction & Finance (U. S. Realty & Nat'l City)
1st pref. stock	75% of total cost and 100% of issue	0	0
2nd pref. stock	0	25% of total cost or equity 100% of issue	0
Common stock	40% of issue	40% of issue	20% of issue

Thus, from the point of view of the construction industry, the Beaux-Arts plan may be summarized in very simple terms. The owner of a valuable plot of land goes to the officers of the U. S. Realty & Improvement Company and persuades them that they could do no better than to construct and finance a building on that particular plot. The land owner contributes the site, at a fair value, as the 25 per cent equity in the deal, and takes the 6 per cent second preferred in payment, plus a 40 per cent share in the future common stock profits. U. S. Realty agrees to finance the remainder of the cost, namely 75 per cent, which it does by joining with the National City Bank in underwriting the sale to the public of the first preferred shares. U. S. Realty also constructs the building. The profit to U. S. Realty and to the National City interests is 20 per cent of the common shares, each receiving 10 per cent. This common goes to the U. S. Realty Management Company in which both U. S. Realty and the Bank have an equal interest. Practically everybody, public included, contributes money, land and services at cost and defers his profits for several years.

Clearly, this method of long term financing, with deferred profits and public participation in the ownership of a building, is revolutionary in its efficiency. It raises real estate finance to a more stable investment basis. Still more important, it requires, to no small extent, that the adoption of the chain principle be considered in order to induce all interests concerned to accept deferred profits. With a chain of successful properties, people are willing to undergo a few lean years if they know that they are investing in a sound, continuing enterprise, by a method which steadily increases their equity, causing appreciation of the common stock and which, at the end of the waiting period, begins to flower with expanding profits. More accurately described, "deferred profits" really means postponing the taking of profits. In a successful real estate enterprise of the type here considered, the profits theoretically increase from the start, but are not taken out immediately. Particularly, they are not taken out in advance, as is sometimes done in "shoe string" operations. They may, however, be "anticipated" through the appreciation of the common stock before it pays dividends.

In conclusion, it should be said that the architect's position in the new development is important. Architects have every reason to approve efficiency and sound investment value in buildings. Particularly will they approve of the initiative of the group of architects who form the majority of the owners of the Beaux-Arts Development Corporation. These men seem to have applied the new ideas on a broad and consistent scale. They have shown, I think, the possibilities of the leadership of architects in improving the methods of building finance.

THE SUPERVISION OF CONSTRUCTION OPERATIONS

BY

WILFRED W. BEACH

CHAPTER 7, FOUNDATIONS AND MASONRY MATERIALS

IN these dissertations on the general subject of construction supervision, we are seeking to discuss the problems confronting a superintendent somewhat in the order that they are presented to him during the progress of the work. He arrives at the site about the time the building is being staked out and the excavating is beginning. Shortly thereafter, materials start to arrive,—form lumber, cement, concrete aggregates, reinforcing rods, brick and other masonry materials. The superintendent has, perforce, to inspect these and to watch the excavating at the same time. Ordinarily, the latter duty is not onerous, as soil conditions in small areas are generally uniform. It is only when they lack such uniformity that supervisory duties at this preliminary stage become at all pressing.

Two features somewhat out of the ordinary are introduced in connection with the schoolhouse work here described, to show that the need for the exercise of diplomacy and acumen may exist at the initiation of proceedings, perhaps in as great a degree as at any other stage of the work. One such feature is a presumption of irregular soil conditions, demanding a local test; and the other is the supposition of an improper personal interest in certain phases of the operations by members of the board of education. Such an undue interest may sometimes develop into one of the most embarrassing phases of the work. Its ramifications may be extensive and most ominous, without being readily discernible or easily traced. Pressure may be brought to bear from unexpected sources to influence leniency in the judgment of certain materials or even in the retention of incompetent employes and subcontractors. In such an event, the architect has but one course to pursue, and that is to act in accordance with his best judgment for the good of the building, regardless of consequences.

After the board meeting on Tuesday afternoon, the architect and superintendent were taken to the gravel pit by the contractor. The storm of the preceding day had done considerable damage by washing the top soil down into the pit and mixing it with the sand and gravel. At first sight, it appeared useless to attempt to extract any more usable material from the place, but the contractor was determined and promised to put in a power pump and washing plant, if needed. With this understanding, deliveries were permitted to continue, though the architect had heard severe criticism of the gravel in board meetings, originating, presumably, with parties having crushed rock to sell. But both sand and gravel were of such excellent quality that it would have been unjust to forbid their use, if the silt could be kept out or removed.

Returning to the building site, they found two large trucks unloading the first deliveries of common brick. These were not being dumped but were being handled like face brick. This fact alone was enough to arouse suspicion, and hence an immediate inspection was made, revealing a much too great percentage of soft brick.* Evidently the yard was not sending out the "selects" approved by the superintendent. The architect would have rejected the whole delivery without further ado, but the superintendent called his attention to the interest of a board member in the transaction and proposed having them culled at the expense of the manufacturer to bring them up to grade. The contractor telephoned the yard but could get no satisfactory assurance at that end. He turned to the architect. "I suppose you know," he said, "that this lumber dealer on the board has a one-third interest in that brick yard, but do you fully realize what we are up against on this job? So far as I have been able to find, the chairman is the only one on the board who hasn't an axe to grind. Except for him, everyone, including the husband of the woman member, is trying in some way, open or underhanded, to make something out of this schoolhouse. So you men are not only superintending me but the owner's representatives as well; a nice situation. Now, I'm supposed to be saving a dollar a thousand by buying these bricks instead of shipping in good stuff but, if you say these are rejected, back they go, and I'll shoot in some from my regular supply which I know will be O. K." Before a reply could be made, the lumber dealer drove up, saying he had been advised by the yard that there had been a mistake in the hauling, that the brick had been loaded from the wrong pile. This the contractor knew to be a fabrication, but they listened to the dealer's further assurance that he would have these culled and that there would be no further complaint about the quality. There they allowed the matter to rest for the time being.

The steam shovel and trucks were working in the excavation, but they could not function to advantage in the lower portion on account of the

* Specification for common brick: "All common brick shall be square-edged, sound, hard-burned, firm in texture, fairly uniform in size, shape and color, and free from lime lumps, cracks or other serious defects. No soft or salmon colored or other unduly absorbent bricks accepted. All shall be first-hand, 98 per cent whole."

mud. Some of the trucks were being used for hauling cinders to improve the temporary driveways. The architect was much concerned about the character of soil that would be encountered at the level of the bottom of the footings. The excavating had thus far disclosed nothing but sandy loam (below the black top soil), with a small percentage of clay. Borings and other excavations in the vicinity indicated this to be the general character of the terrain for a depth of from 3 to 5 feet, at which level the increasing ratio of clay and gravel tended rapidly to replace the loam, thus providing a bearing stratum, several feet in depth, which the architect deemed capable of sustaining a superimposed loading in excess of 4,000 pounds per square foot. There had been small doubt of reaching such a stratum, as the footings were originally designed, but, having raised them 3 feet, the situation was no longer one of certainty.* It was therefore decided by the architect that as soon as excavating had reached bottom (a plane 9 feet below finished basement floor), the superintendent would have two tests made by the contractor at points to be selected. This procedure was covered by two specification provisions. Under the general subject of "Testing Materials" was found:

"TESTS shall be made by the Contractor of his workmanship and materials and of the operation of mechanical equipment as required by law and the Contract Documents, all in manner directed by the Architect or approved by him. All expenses in connection with such tests, including the use of materials, labor, power, light, heat and equipment, shall be borne by the Contractor, unless otherwise stated.

"ADDITIONAL TESTS, not called for by the specifications, shall be provided by the Contractor under direction of the Architect, at the expense of the Owner, except that, in cases where such tests give evidence of defective materials or workmanship for which the Contractor may be required to make allowance or replacement, then the cost of such tests shall be borne by the Contractor. The expense will be audited by the Architect who, if same is to be charged against the Owner, will have an extra order issued for the amount as elsewhere provided, which amount will include 10 per cent to cover Contractor's overhead and profit.

"NOTICE OF TESTS shall be given to the Architect or his Superintendent by the Contractor in due time to permit advising all those interested. No tests will be deemed valid unless duly witnessed by the Architect or his Representative.

"RECORDS of all tests, neatly typed on 8½" x 11" sheets, accompanied by necessary diagrams, charts or photographs to thoroughly explain same, all in duplicate and duly certified and signed, shall be prepared by the Contractor as part of the expense of the tests, and deposited with the Architect."

And, under "Trench Excavating" in "Foundation Work":

"INSPECTION AND SOIL TESTS. Bottoms of all trenches and pits shall be left level, free from rubbish and reasonably smooth. No concrete for footings may be poured until the Superintendent has had opportunity to examine surfaces to be covered. He may then order the surfaces to be placed in better condition or may order a test of the bearing capacity of the soil made by the Contractor at the Owner's expense, after which the bottom of the trench or pit shall again be prepared at directed depth and re-submitted for inspection."

After the architect left, the superintendent strolled over to the brick yard to confirm his suspicion that there had been no mistake in the delivery of the wrong brick. Being after hours, no one was about the premises. He could see beyond question that there had been no activity around the pile of "selects" since he had first inspected it. A large new pile, from which deliveries to the school had evidently been begun, was of the same character of brick as those already unloaded at the site. It was obvious that, if the latter had to be reculled, the same would be true of this entire pile, containing over 50,000 brick. No doubt remained in the mind of the superintendent as to the intent of the brick makers. The pile of "selects" had been made up for exhibition purposes only, with no intent to deliver therefrom. He could visualize the trouble ahead if the manufacturers continued deliveries, relying upon the "pull" of their partner on the board to prevent rejection. He was early on the job next morning and stopped the first brick truck, loaded as he anticipated, and notified the contractor not to permit the brick to be taken off. The driver telephoned his office, and shortly there again appeared the ubiquitous lumber dealer who now contended that it had been arranged with the architect on the preceding day that the brick should be culled at the job. The superintendent pointed out that this applied only to what was already unloaded and said with finality that no more improper material would be permitted to be brought to the premises. The dealer tried to reopen the subject from the beginning by arguing that the brick were being discriminated against; that, inasmuch as none were destined to be exposed to the weather, better brick than those offered were not needed. To this the superin-

* See Chapter I, pages 30 to 34 of T. M. Clark's "Building Superintendence," The Macmillan Company, 1895. There is much of value to the young superintendent in this volume, but one must bear in mind that building conditions and methods are constantly undergoing changes, and hence certain items treated by Mr. Clark, such as the discussion on concrete here referred to, are obsolete.

tendent rejoined that it was his business to see that all material entering into the construction was up to the standard* that the owner was paying for. The dealer was so palpably inclined to make an issue of the matter that the superintendent telephoned to the chairman of the board and asked him to come over and be present at the discussion. His appearance was somewhat disconcerting to his fellow board member, who was asked to re-state his case. Then, before anything else could be said, the chairman drew him aside and, after a brief colloquy, the latter spoke to the truck driver and the two drove away, much to the surprise of both contractor and superintendent. The chairman explained that he had anticipated some such *impasse* from the beginning and had foreseen the advisability of the dealer's resigning from the board on account of his extensive interest in selling construction materials. This he had just consented to do, and hence would deliver no more brick until after his official connection had been formally severed. The contractor thereupon said that he would cancel the order for the remainder of the brick, and he agreed to see that those already on the ground were properly sorted before any were used.

Unfortunately, architects and engineers (and even some specification men) are not of one accord in their attitude toward common brick quality. For this there are probably several reasons. One is that engineers like to provide tests for structural materials,—and ordinary common brick will not stand severe tests. "Good bricks should be quite hard and burned so thoroughly that there is incipient vitrification all through the bricks. A sound, well burned brick will give out a ringing sound when struck with another brick or with a trowel. A dull sound indicates a soft or shaky brick. This is a simple and generally a sufficient test for common bricks, as bricks with a good ring are generally sufficiently strong and durable for any ordinary work," according to F. E. Kidder in "Building Construction and Superintendence." "Very soft, underburned bricks will absorb from 25 to 35 per cent of their weight in water. Weak, light red brick, such as are frequently used in filling in the interiors of walls, will absorb from 20 to 25 per cent, while the best bricks will absorb only 4 or 5 per cent. A brick may be called 'good' which will absorb not more than 10 per cent," according to Baker in "Masonry Construction."

One frequently finds an architect's specification which carefully discriminates between the different grades of hollow clay tile, classified according to their function in building, but making no such distinction between the various purposes of the common brick. In general, three distinctive grades of hollow tile are recognized: well burned "'load-bearing," capable of withstanding prescribed crushing loads; well burned "non-load-bearing," suitable for any walls subjected to limited light loadings; and soft porous tile for partitions, needing only sufficient density to withstand rough handling. The same classification could be used for common brick, if intended for the same usages. But, as few common bricks are used for non-bearing partitions, the soft grade is "taboo" and, since any good common brick is to be considered "load-bearing," the one grade, which may be termed "good," is the only grade permitted under the majority of architectural specifications. However, in some communities, the ordinary run of local brick in common use is not up to such standard of "goodness," and the "outside" architect is confronted with the problem that we have been discussing. Investigation will likely disclose the fact that the better class local architects in the vicinity where such brick are the only brick made, are accustomed to call for two grades of common brick, thus:

"COMMON BRICK shall be firm and compact, well and evenly burned, of a good grade of clay or shale, free from lime lumps, of fairly uniform size, shape and color, free from cracks or other serious defects and 90 per cent whole. They shall not have over 20 per cent absorbency. They may be used for all brick masonry, except where select common brick or face brick are called for.

"SELECT COMMON BRICK shall be equal in all respects to the foregoing specification for common brick, except that they shall be hard burned, 98 per cent whole, and shall not have to exceed 10 per cent (or 5 per cent) absorbency. They shall be used whenever called for, also for all piers laid in cement mortar and for the facing of all outside walls, except where face brick or other material is called for."

Probably such "selects" are shipped in, in those instances. A too exacting common brick specification is unwise, since unnecessary hardness means undue vitrification, which makes the brick difficult to lay, slippery when wet or cold, and not readily adherent to any but pure cement mortar. In the work being used here as an illustration, the walls above the basement were chiefly of load-bearing hollow tile, with facing of pressed brick, common brick being used only for certain piers and walls of heavy loading, and for certain basement partitions. The brick were correctly specified, and the specification properly interpreted.

The brick subject being disposed of for the time being, the contractor and superintendent next gave attention to conditions relating to the excavating. The general excavating (subcontract) extended to 6 inches below the tops of the footings (see Fig. 10), but the additional hand

* See Chapter VII of Part I of "Building Construction and Superintendence," by F. E. Kidder (William T. Comstock Company, 1923), for an excellent dissertation on the manufacture and characteristics of the different kinds of brick.

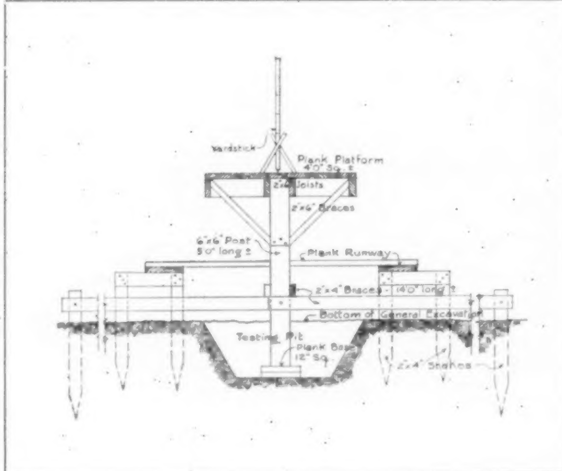


Fig. 9. Platform for Testing Bearing Capacity of Soil

work of trenches and pits was included under "Concreting" for obvious reasons. Specifications for this work read:

"GENERAL EXCAVATING is assumed to extend to sufficient depth (9 inches below upper planes of various basement floors) to permit material from trenches and pits to be distributed and compacted under cinder floor fill. This Contractor shall provide additional cinders or sand, if any is needed, to bring areas up to proper planes to receive the floor material as specified, or shall remove any surplus.

"ALL PITS AND TRENCHES shall be excavated to neat size required, if banks are sufficiently firm to be used as forms for concrete. If not, the form work required for upper portions of footings and pit walls shall be extended to bottoms of same, and the excavating shall be increased to accommodate same, without additional cost to the Owner."

Then followed the paragraph on "Inspection and Soil Tests" previously quoted. This was supplemented by a paragraph under "Concrete Footings":

"INCREASED DEPTH OR WIDTH OF FOOTINGS shall be provided by the Contractor when so ordered by the Architect, for which the Contractor will be allowed an extra price of fifty cents (50 cents) per cubic foot of concrete thereby made necessary, which price shall include also the cost of required additional excavating, back fill, overhead cost and profit. If additional form work is required in such case, it shall also be provided and will be paid for at the rate of five cents (5 cents) per superficial foot. Additional reinforcement shall also be provided, if required, and will be paid for at the rate of four cents (4 cents) per pound. All such extra payments will be made in accordance with provisions in General Conditions covering same."

A formal order was received from the architect's office next morning, covering the labor and material necessary for two soil tests, and the superintendent delivered copies to the contractor and the secretary of the board, directing the former to proceed with the work on authority of the architect's signature, without waiting for formal board action. This "Change Order No. 3" was in form similar to those preceding, but the clause covering remuneration read: "for which material and labor, you will be reimbursed by the Owner to the extent of the net cost of same, plus 10 per cent; subject to the audit and approval of the Architect's superintendent, which gross sum will be added to your contract price."

Bottom was reached that morning along the south end of the east wing, and a shallow pit was dug out and leveled at the grade at which footings were supposed to rest. For testing purposes, a platform was constructed as shown in Fig. 9. This was supported and rigidly braced atop a post, the bottom of which was exactly 144 square inches in area. This contrivance was erected in the pit, extreme care being taken that the base should rest on original soil, perfectly level, since any tipping would cause compression on one side or corner and render the test worthless. While held rigidly in this position, the post was anchored in each of four directions, by means of a "two-by-four," 14 feet long, placed horizontally (so as to offer no resistance to the settlement of the post), and each outer end was attached by means of a heavy spike to a stake driven firmly into the ground, the other end similarly spiked to the post. Another spike was driven at the center of the platform, and a yardstick was erected on the head and braced in position. A reading was taken on the yardstick by means of a surveyor's level, and referred to a permanent bench mark. The object of resting the end of the yardstick on the nail head is to have a definite spot to which reference can be had in case the yardstick is displaced.

Sacks of cement were used for loading, placed two at a time on opposite sides, with much precision, to avoid disturbing the set-up; next, two were placed on the other two sides and one on each of the four corners, eight in all, making a superimposed load of 800 pounds. A second reading then taken showed a settlement of 1/8 inch. Another 800 pounds was then deposited, but the reading on that showed no further appreciable settlement, nor was more noted until the fifth such loading, when the platform went down 5/16 inch more. The test was thereupon stopped and the loading left to stand over night, with a watchman to guard it. In the morning it was found to have gone down 3/8 inch more, a total settlement of 13/16 inch, which the superintendent deemed excessive. He might recommend increasing the spread of the footings at this end

(which was the lowest part of the basement, containing the boiler room) or carrying them down to a firmer stratum, if within reasonable depth. It appeared that they were in exceptionally poor soil, immediately at the head of a small ravine, and that it might be better to increase the depth throughout a limited area, rather than to make a re-study of the footings and their reinforcement, so he ordered another hole prepared, 3 feet deeper, and repeated the test. It was a new proceeding in the locality and attracted a considerable "gallery," and proved to be the cause of much comment. As a result, the laborers were distracted and less careful with the next test, and therefore made a failure of the set-up. The third was unevenly loaded and likewise failed. The next was given due care and succeeded, both as a test and in demonstrating the bearing capacity of the stratum reached. The first load reading showed 3/16 inch settlement, and the next (with 1,600 pounds on) an additional 1/16 inch. Thereafter, no appreciable difference was detected, even with 4,000 pounds on the platform. The superintendent then ordered another 800 pounds added, which went down another 1/16 inch. Next morning, the loading was found to be stabilized at a total settlement of 5/16 inch, which was deemed quite satisfactory, in view of the fact that the first ¼ inch was an initial settlement.

Particular note was taken of the characteristics of this substantial bearing stratum, and the trenches were carried down to it at the southwest corner and stepped up from it (as the stratum tilted) until normal height was reached, all in accordance with telephonic instructions from the architect. He arrived on the scene before the final testing set-up was dismantled, inspected the reports of the tests, and estimated the sum due the contractor for the additional concrete, excavating and back fill, as provided in the specifications. Change Order No. 4 was written accordingly, covering 840 cubic feet of concrete, etc., at 50 cents a foot, a total of $420 extra for the item. To this was added the sum of $115 for the cost of conducting the tests, as provided in Change Order No. 3.

The ground had sufficiently dried out after the rain for observation as to the amount of moisture the soil would normally carry. The architect decided to adhere to the provisions for waterproofing included in the contract, which will be treated of in another chapter. He had been uncertain as to whether or not membrane waterproofing was indicated for the boiler room floor and lower walls, as specified for the swimming pool. His judgment was that the tile drainage around the walls would be sufficient to keep this section dry, even at the depth of the ash pits under the boilers, in this case the lowest point.

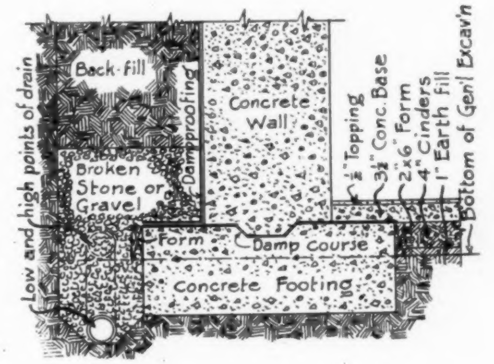


Fig. 10. Section Through Footing

Careful observance of all soil conditions is of first importance in building construction, especially when the architect is working in unfamiliar territory. The Chicago building ordinance gives these restrictions as to maximum loads permitted:

	Lbs. per sq. ft.
On pure clay, at least 15′0″ thick	3,500
On pure clay, dry and compressed	4,500
On pure firm sand, at least 15′0″ thick	5,000
On a mixture of clay and sand	3,000

That these allowable loadings are "safe" to the extent of being extremely light is proved by experience and evidenced by competent authorities. Those given in Kidder's "Architects' and Builders' Pocket Book" are about twice as heavy. In point of fact, it is difficult to lay down any fixed tabulated figures assumed to apply to different soil compositions, though several writers quote what they consider a "summary of good practice."* It will be seen that these weights in tons per square foot from the New York building code, 1916, are much greater than the loadings used in Chicago:

	Tons
Wet clay	1
Wet sand or firm clay	2
Sand and clay, mixed or in layers	2
Fine and dry sand	3
Dry hard clay or coarse sand	4
Gravel	6
Soft rock	8
Hardpan	10
Medium rock	15
Hard rock	40

The two important factors relating to foundation bearings are that a certain safe loading shall be arrived at and that the various footings shall have been so designed that the loads shall be fully

* See "Foundations by Albert M. Wolf" in Hool & Kinne's "Reinforced Concrete and Masonry Construction"; also "Foundations on Land" in Merriman's "American Civil Engineer's Handbook."

equalized for all foundations, guaranteeing equal settlements (if any) throughout the entire building area. If one uses a reasonable factor of safety in his footing load computations and these are free from error, one need have no fear of settlement cracks appearing, providing that the supporting stratum is uniform in character and that there is no undue variation in the subsequent live loading. It is therefore the superintendent's duty to closely observe the character of the stratum on which the footings are deposited and report for consideration any lack of uniformity. A location similar to that we have presupposed for discussion may disclose such a dip in the harder subsoil as to demand considerable spread of footings or even the driving of piles.*

Much of the requisite ability to judge soil-bearing capacity by inspection is solely a matter of experience. The superintendent must train himself to expertness in this particular. For soils manifestly too soft to attempt a spread footing (with carrying capacity under 2,000 pounds per square foot) or where the stratum overlying such soft material is too thin, recourse must be had to some means for compressing such soil, or for carrying the foundations down to bedrock or suitable hardpan. The design and supervision of pile, caisson and concrete-filled well foundations is a branch of engineering demanding diligent study by any superintendent confronted with such needs.**

On straightaway concrete footing work, which constitutes an overwhelming percentage of all present-day foundations in this country, a superintendent has little to worry him, other than watching the concrete and checking dimensions, neither of which is, however, to be slighted in the smallest degree. Contractors have been known to make their trenches an inch or more scant in depth or width, or both. A saving of 1 inch in the depth of all footings of this school building would have totaled about 270 cubic feet of concrete and 10 cubic yards of excavating; and of more importance is the fact that it would have cut down the efficiency of the concrete from 6 to 8 per cent.

It is customary, in soil of sufficient firmness, to cut square banks and use the natural earth for forms, rather than to line the trenches with wood. In either event, there are frequent droppings of earth into the trenches (or into the fresh concrete), and hence the excavated material must be kept well back and adequately shored. Some architects specify that the bottoms of trenches shall be tamped before concrete is poured. Others prefer to have the concrete deposited directly on the natural earth bed, without tamping, because the presence of a tamp in the trench offers a constant temptation to compress in place the loose material that should be removed, if specification requirements are to be complied with. In either event, the superintendent must carefully watch the bottoms and sides of the trenches just before and during pouring and see that all surfaces are in proper condition to be covered. He must also be a good judge of the water-bearing capacity of soil strata. Foundation work must frequently be carried on in wet weather, in which event it may be found advisable to proceed with soil tests under unfavorable conditions. Such tests have been made and trench bottoms leveled in mud and running water, with a pump constantly at work. Ideal conditions are not always at the command of the superintendent. He takes conditions as he finds them and does his best, his goal being the securing of proper results.*

When the bottom of the general excavation for the school building was reached in the east wing and the trenching (which, with the foundation work, was being handled by the contractor's own forces) was begun, the superintendent told the general foreman that shoring was specified. This was covered by a special provision under "General Excavating," in addition to the paragraph in the "Supplementary General Conditions" quoted in Chapter 4:

"SHORING. The Contractor shall provide and install all shoring, sheet piling and other bracing required to maintain the banks of all excavated areas until foundation work has been approved for back filling. The Contractor shall be wholly responsible for the retention of all banks, but his shoring or other false work will not be permitted to encroach upon space required for foundation construction or form work."

The superintendent and foreman agreed that this left the matter to the option of the contractor, who would obviously be the loser if damage resulted from lack of foresight in this particular;

* A central heating plant chimney at the University of Illinois, Urbana (Temple & McLane, architects, 1897), has a foundation 20 feet square on the bank of the historic Boneyard Creek. In this small area, the variation in the bearing strata is so abrupt that the footing was divided diagonally in halves, one of which rests on firm soil and the other on a number of wood piles. At last account, the stack (150 feet high) was as erect and firm as when first put to use.

** For dissertations on heavy foundation work, the reader is referred to "Foundations, Abutments and Footings" by Hool & Kinne, "Pile Foundations" in "Reinforced Concrete and Masonry Structures" by the same authors, "Improvement of Bearing Capacity" in Merriman's "American Civil Engineer's Handbook," "Piling in Compressible Soils" in Volume 1 of "Architectural Construction" by Voss & Henry, "Foundations on Compressible Soil" in "Building Construction and Superintendency" by F. E. Kidder, or an exhaustive treatise on the subject of "Piles and Pile Driving" in Dr. J. A. L. Waddell's "Bridge Engineering."

* Part of the footings of a three-story, office and apartment building of fireproof construction in Mitchell, S. D., are on quicksand. This shifty material will stay in place so long as the pressure against it is equal in all directions. A soil test such as described proved that the sand would carry 3,000 pounds per square foot and the loads were distributed accordingly. Under similar conditions in Cairo, Ill., a locomotive was used to pump water from the basement of a freight house, with the result that sand in the unfloored space went with the water, a footing was undermined, and considerable settlement took place, causing a bad crack, before the pumping was stopped.

hence the foreman said he would report that the banks were apparently solid, and that shoring at that depth was not customary in that locality. The contractor could then act as his judgment dictated. Before shoring was ordered, another rain occurred, immediately after which the first truck load of shipped-in brick was dumped too close to the northeast corner of the excavation, causing a small landslide which caught a man in the trench and broke his leg. Thereupon, all banks more than 6 feet high were shored, and no further trouble resulted. It will be noted that the owner, architect, superintendent and foreman were free from blame in the matter, and that the responsibility had been placed where it belonged; but the man of most experience had guessed wrong. No one has ever become infallible in the "building game."

Excavations in rock, or in sand or gravel containing boulders, necessitate specification clauses covering such conditions. If they are definitely predetermined, the contract may be formulated accordingly; but it is common practice to cover uncertainties by demanding unit prices from bidders on excavated materials out of the ordinary, thus:

"ROCK EXCAVATION. It is assumed that the material excavated will be such as can ordinarily be handled by a steam shovel. If a boulder or boulders or solid rock be encountered of mass in excess of one cubic yard, necessitating blasting or breaking by other means, the Contractor will be allowed a unit price per cubic yard for same in addition to the amount of his contract.* Each bidder is requested to state in his bid the gross cost per cubic yard for such excavating in addition to that included in his contract for ordinary excavating."

It is then up to the superintendent to determine what excavated materials are affected by such a clause and to make due allowance for them, if allowances are indicated. Advance data as to soil conditions by borings or digging are informative but not conclusive. An architect designs his footings according to the best information available, and has the bidders make their proposals accordingly, eliminating all uncertainties, so that all bids will be on like quantities. The best practice does not countenance "passing the buck" to the contractor by means of such uncertain demands as:

"ROCK. Level off rock at depths indicated, and if at these levels firm rock is not found the Contractor shall excavate to greater depth until proper surface is secured."

If there is a possibility that usable sand or gravel will be found in the excavation, the superintendent may be charged with the responsibility of determining its fitness for use in concrete or mortar, thus:

"SAND AND GRAVEL. As excavating progresses, the Superintendent shall be afforded opportunity to inspect materials uncovered and may direct the separation (without additional expense) of all sand and gravel suitable for building purposes. Same shall be kept free from earth and shall be stored on premises to be used as directed. The Contractor shall allow a unit price of $2 per cubic yard for all sand and gravel so obtained and used."

Forcing the contractor to pay current prices for materials so used makes him more or less indifferent as to their incorporation in the work, and makes it simpler for the superintendent to control such usage. When the use of material from the excavation is permitted at a direct saving to the contractor, one who is unfair needs unusual watching. The unit price for extra concrete also applies in event of the discovery of some old cistern or other filled-in hole in the excavated area. If this extends below new work shown on the drawings, proper attention should be given to it. Footings should be carried to original soil under the same proviso as applies to other soils of insufficient bearing capacity, as previously quoted. If only floors occur over the old excavation, or if it is only a narrow trench crossing under a footing, such reinforcement can be added to the concrete as will guarantee safety, without adding bulk.

Thus, with premises well founded, calculations carefully made and checked, and construction adequately supervised, one is reasonably assured of satisfactory results; but, if changes are to be made from the footings as originally designed, there should be no question as to whose is the responsibility for such changes or for conditions resulting therefrom.* On compressible soils, where the spread of the footings is such that minor settlement is anticipated, one should bear in mind that such "live loads" as are imposed upon warehouse floors act as "dead loads" after coming to rest for a time. This means that, upon the completion of such a structure, it may be expected that all structural dead loads will have operated to produce their permanent effect on the footings, whereas the more or less permanent live loadings are yet to be applied. It is therefore of much import that such foundations be designed with sufficient spread to permit of minimum settlement, unequal as it is bound to be.

* Or, if preferred, will be allowed a fixed amount per cubic yard.

* A case is on record where the building committee of a large church, employing non-resident architects, hired their own superintendent, one familiar with local conditions. He found that the footings in certain locations were inadequate on account of soil conditions, and took it upon himself to change them and so notified the architects. Later, when bad settlement cracks occurred, the owners sued the architects for heavy damages, but the latter were able to show that they had no direct knowledge of the conditions uncovered by the excavating, that the information as to the change in footings was definite and not submitted to them for approval, and that they could not be held responsible for effects after being relieved from control of the causes. Such incident affords ample testimony to the need of the owner's insistence that the superintendent or clerk-of-the-works shall always be employed by the architect direct,—never by the owner. There should be no divided responsibility for structural design.

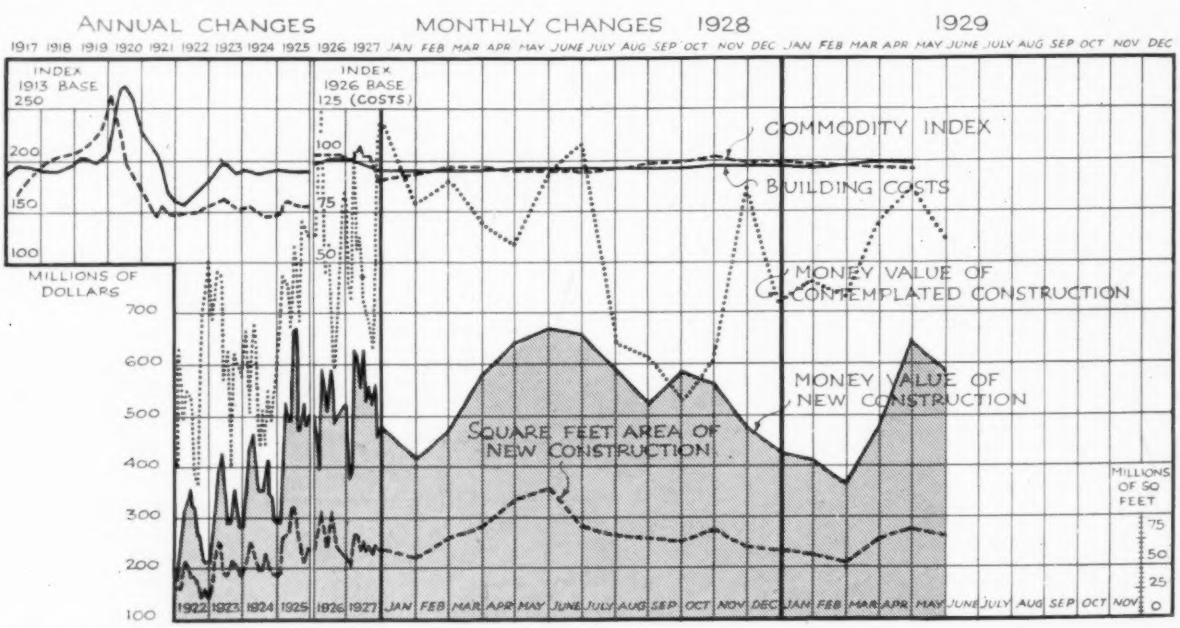
THE BUILDING SITUATION

A MONTHLY REVIEW OF COSTS AND CONDITIONS

THE anticipated increase in construction activities during the month of May has only partly materialized, a fact due in part to recent labor disputes in New York. The value of construction contracts awarded in the 37 eastern states during the month of May was, according to the F. W. Dodge Corporation, $587,765,900, a decline of 9 per cent from the preceding month, and 12 per cent lower than the total for May, 1928. Total construction for the first five months of 1929 shows a decrease of 11 per cent from the 1928 figures for a similar period.

The effect of the labor dispute in New York is evidenced in the decided falling off in contracts awarded in the New York-northern New Jersey district. The May total of $122,474,600 was 28 per cent below that of April, and 34 per cent below the figures for May, 1928. This brings the total for the first five months 24 per cent below that for 1928. The middle Atlantic states suffered a similar recession. The May figures showed contracts valued at $59,419,500. This is a decline of 44 per cent from the April total, and is 23 per cent below the total for May, 1928. In spite of these losses the volume of work awarded for the first five months of 1929 was only 7 per cent less than during 1928. The New England states May figures of $43,745,300, showed an improvement of 7 per cent over April, but a decrease of 28 per cent from May of last year. Less significance is attached to this decline when it is noted that the 1928 figures for this district were abnormally high, breaking all previous May records. Contracts for the five months were 17 per cent below the five months of 1928. With a total of $71,472,100, contracts awarded in the Pittsburgh district amounted to 17 per cent more than April and 8 per cent more than May of last year. This high figure brought the total since the first of the year up to 1 per cent above that for a similar period in 1928.

In the central western district the figures for the first five months ran 10 per cent below the five months of 1928. Nevertheless, the May figures of $199,136,400 were 18 per cent above the April record, and 3 per cent higher than May, 1928. The northwestern district shows a decided improvement when compared with either the previous month or the previous year. The May contracts amounted to $13,322,400, an amount 21 per cent ahead of the April total and 40 per cent ahead of the total recorded for May of last year.



THESE various important factors of change in the building situation are recorded in the chart given here: (1) *Building Costs.* This includes the cost of labor and materials; the index point is a composite of all available reports in basic materials and labor costs under national averages. (2) *Commodity Index.* Index figure determined by the United States Department of Labor. (3) *Money Value of Contemplated Construction.* Value of building for which plans have been filed based on reports of the United States Chamber of Commerce, F. W. Dodge Corporation and *Engineering News-Record.* (4) *Money Value of New Construction.* Valuation of all contracts actually let. The dollar scale is at the left of the chart in millions. (5) *Square Foot Area of New Construction.* The measured volume of new buildings. The square foot measure is at the right of the chart. The variation of distances between the value and volume lines represents a square foot cost which is determined, first by the trend of building costs, and second, by the quality of construction.